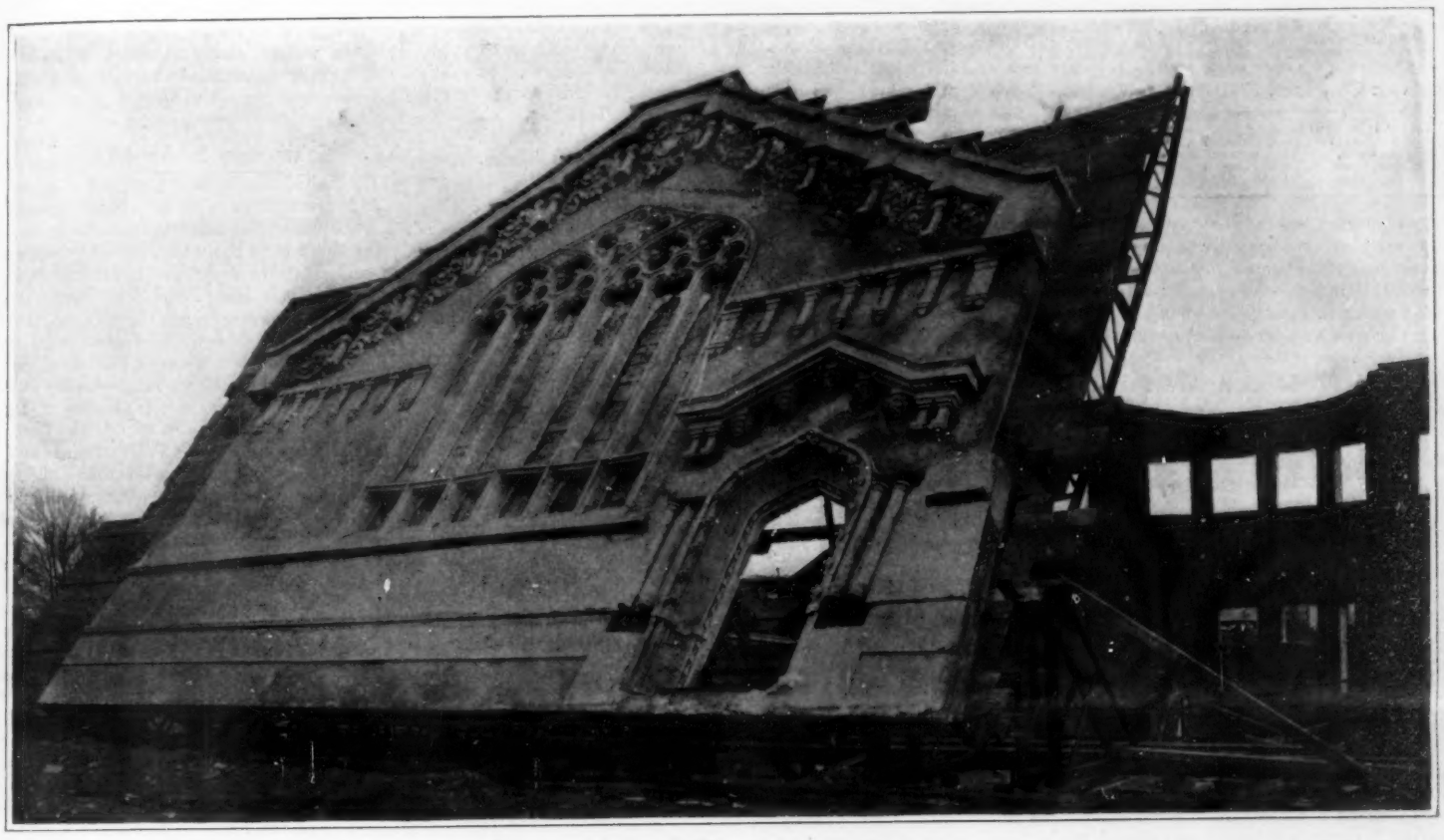
SIXTY-SEVENTH YEAR

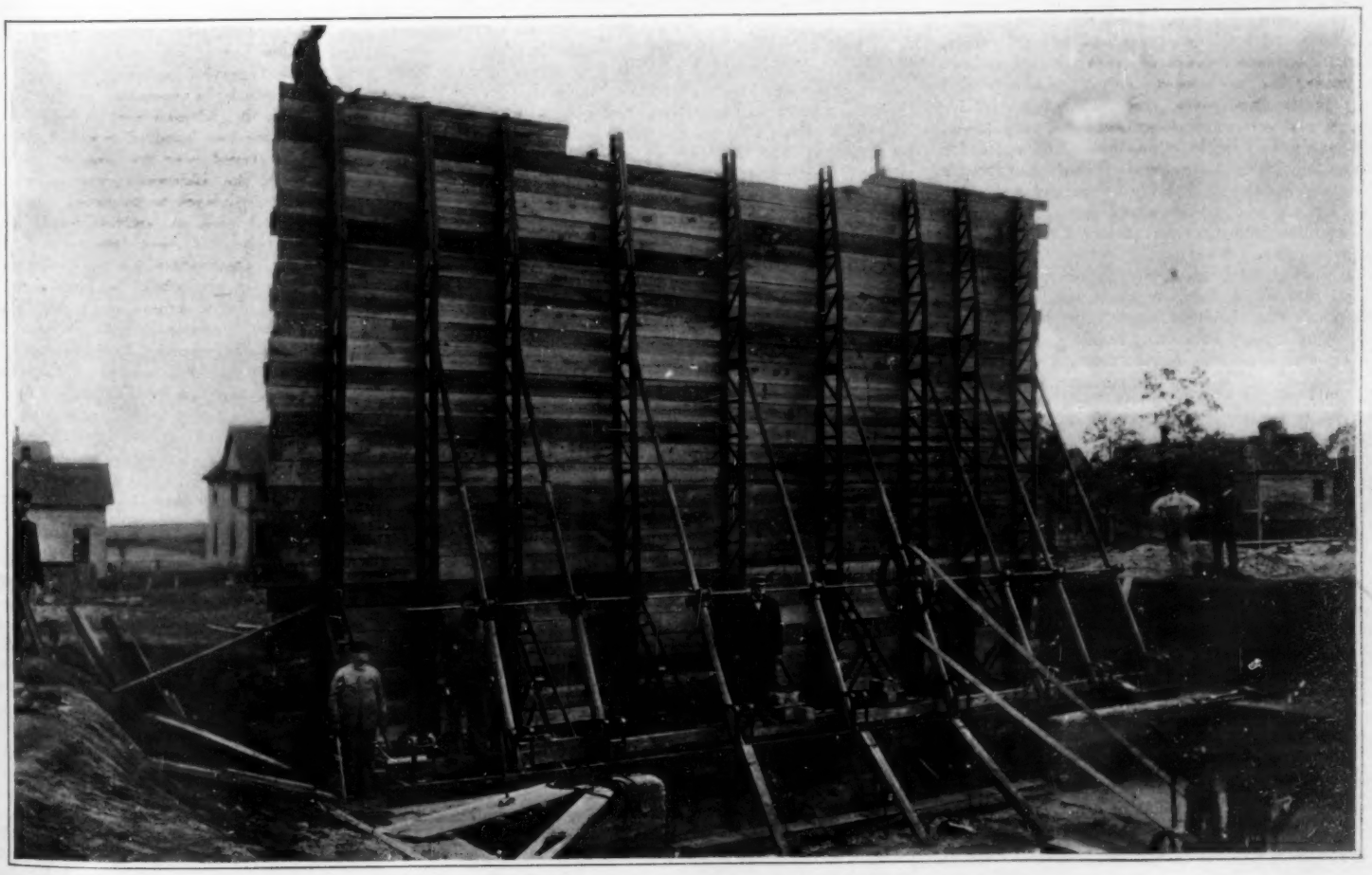
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CV. NUMBER 5] NEW YORK, JULY 29, 1911 [10 CENTS A COPY $3.00 A YEAR



Lifting the church wall in place by means of jacks.



The back of the wall, showing the method of support.—[See page 97.]

BUILDING A CHURCH FLAT ON THE GROUND IN SECTIONS

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, JULY 29, 1911

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary and Treasurer; all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter

Subscription Rates

Subscription one year $4.00
Postage prepaid in United States and possessions, Mexico, Cuba, and Panama.
Subscriptions for Foreign Countries, one year, postage prepaid, 4.50
Subscriptions for Canada, one year, postage prepaid. 4.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year, $4.00
Scientific American Supplement (established 1876) . . " " 5.00
American Homes and Gardens . . . . . " " 5.00
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check.

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Good Roads That Are Permanent

CHIEF among the qualities of a good road is that of durability, and durability can be assured only by first-class work in construction and by ceaseless vigilance in maintaining the road in perfect condition. It goes without saying that the highways of America, considered as a whole, are not to be compared with those of the older European countries. After a motor car tour through Europe, the returning American becomes painfully aware of the fact that in this most important matter, his country, even if we allow for its comparative youthfulness, is many decades behind that stage of development to which its wealth and enterprise should have carried it long ago. Although we say this with full appreciation of the fact that some of our States, and notably New Jersey and Massachusetts, have done effective work in building up a system of highways, the fact remains that, taken as a whole, the United States has not done much more in this matter of good roads than make a beginning—the work has yet to be done.

It is not that we have been parsimonious in the matter of appropriations. Had the money which has been voted by legislatures and county boards, and the enormous amount of work which has been done under the assessment method, been expended wisely in the first place, and followed up by intelligent methods of maintenance and repair—in other words, had we built our roads and cared for them as they build and maintain them in Europe, we do not hesitate to say that for the money and energy expended, our roads would have been in at least one hundred per cent better condition than they are to-day.

The fundamental requirements of a good road are an ample foundation and good drainage. Without these, the most carefully leveled and smoothly rolled top surface is nothing more than a delusion and a snare. Furthermore, a road which has been built with deep foundations, good drainage, and an ample depth of suitable top dressing—unless it be watched and tended with the most solicitous attention—will go to pieces only a little less rapidly than the cheap product of the scraper and horse roller.

We have long believed that in those districts where scarcity of travel and financial inability to provide the necessary funds prohibit the construction of a first-class macadam road, it would be better to invest the time and money in constructing short sections of durable road, leaving the traffic to fight it out with "chuck-holes," deep ruts and mud over the balance of the highway during the winter months. The endurance of a few years of discomfort would be repaid by the ultimate possession of a permanent first-class highway. Moreover, the use of oil or some other of the many excellent "binders" that are now available would make it possible to maintain the unimproved roadway in as good, if not better, condition than that of the old scraper-and-roller highway, which invariably went to pieces after the first two or three frosts and rains of the winter.

In districts where financial conditions and the amount of traffic has warranted the construction of expensive roads, millions of dollars have been thrown away because of the absolutely absurd system of maintenance (if it can be called such) which has been followed. There is no method of construction upon which eternal vigilance is so necessary as on that of the modern macadam highway. This has long been recognized in Europe, where the roadways are divided into comparatively short sections, each of which is controlled by a section gang, provided with a supply of broken rock, gravel, sand, or other road mending material, conveniently distributed in piles along the roadway. Each member of the gang has his wheelbarrow, pick and shovel, and as soon as the slightest indication of breakdown, such as a rut or hollow, is detected, repairs are made before the damage can proceed any further. A century of experience has proved that this is the only way in which a road can be maintained always in absolutely first-class condition; never was the truth of the old adage "A stitch in time saves nine" more strikingly true than in this matter of the upkeep of public thoroughfares.

Sound in the Universe

WE live and move at the bottom of an ocean of air, the earth's atmosphere. One consequence of this is that every mechanical disturbance starts waves of compression and rarefaction, which radiate out from the source, and, striking the drum of our ear, may (if of the right strength and quality) cause in us the sensation of "sound." Among such sensations some affect us merely as "noises"; in others we recognize a more or less well-defined "musical pitch" and "tone quality." Physically the "noise" differs from the "musical note" in that the former is an irregular disturbance, while the latter is periodic and of definite frequency. Not that there is any hard and fast line of demarkation: a rapid succession of impulses, which separately would be mere noises, may impress the ear with a definite sense of pitch. Thus the teeth of a saw, cutting in rapid sequence through a wooden board, produce a sound of definite pitch, though lacking perhaps in musical quality. Or again, a sharp noise of brief duration, proceeding from a point in the neighborhood of a series of equidistant obstacles, such as a line of fence-rails, or a flight of stone-steps, produces upon the observer a sensation in which a more or less well-defined pitch can be recognized. The explanation of this phenomenon is that the sound is reflected back from each fence-rail in turn, and since it takes time to travel, each echo reaches the observer a trifle later than that from the neighboring rail. This case is of special interest, because the sound "heard" contains an element quite foreign to the initial disturbance. Furthermore, the pitch of the sound heard differs according to the location of the observer, so that, borrowing an expression from optics, it might be said that the original disturbance is "analyzed" by reflection from the fence (grating) into its "constituent" waves—each traveling in its own direction, so that it can be singled out by the observer. It is possible that the means commonly employed to analyze light waves act in this way, and perhaps we are not quite justified in imagining "white" light for instance as "composed" of the various spectral colors, these being rather impressed upon it by the prism or grating or other device employed to "analyze" the light, as we commonly say.

Of all the forms of energy, sound would probably be of the least consequence to man, were it not for the one important fact, that sound is the normal vehicle for the transmission of intelligence between individuals. Certain special sounds are recognized by us not merely as "noises," or "musical notes," but as "words," which are associated in our minds with definite concepts, and whose mere mention immediately summons up before our imagination the concepts thus attached to them. Not that speech exhausts all the modes of sound-expression for mental states at our command. Indeed, more elemental and lower in the scale than speech are various inarticulate sounds, such as laughter and crying, calls of various kinds, the groan of pain, the sigh of relief, the shriek of fear, and a host of other emotional expressions. In these man approaches more nearly to the lower animals, who also possess "calls." But the range of our modes of expression by means of sound extends also on the other, the heroic side, beyond ordinary speech. The poet by rhythm and cadence conveys something more than his words alone would say, and in the symphonies of the great masters of music there is borne in upon us a wealth of thoughts that lie too deep for words.

If the ocean of air which envelops us is the medium that carries sound to our ears, and thus places us in sentient communication with the other occupants of this globe, its shore, the void upon which the upper atmosphere abuts, is also the extreme limit of the range of space comprising all things audible to us. No sound, however loud, can ever pass from the earth into space beyond, neither can it penetrate from other orbs to us. The sun's burning eye looks down on us in splendor mute; for though his fiery ocean be lashed by furious gusts, in comparison with which the fiercest earthly gale is but as the soft sighing of the autumn wind, or as the breath of one that slumbers; and though monstrous explosions rend his very bowels, belching aloft great pillars of fire that tower thousands upon thousands of miles; yet of all the crash and thunder and tumult not a whisper escapes to break the eternal silence of infinite space, and the empty void holds close the clamorous secret of the fiery orb.

Seismology in America

THE United States has heretofore lagged behind most other civilized countries in the cultivation of the science of earthquakes, and to this day there is no chair of seismology or department of seismology in any American university.

Shortly after the San Francisco earthquake of April, 1906, a number of scientific men on the Pacific coast organized the Seismological Society of America, which now has a large membership well distributed over this continent, and beyond. We are glad to record the appearance, beginning with last March, of the quarterly *Bulletin of the Seismological Society of America*, published at Stanford University. In the initial number of this publication Prof. Andrew C. Lawson gives a timely review of the status of seismology in this country; while elsewhere in the *Bulletin* appears a list of all the seismographs known to be in operation in North and South America and the West Indies. Probably few scientific men realized how numerous these instruments have become on this side of the Atlantic. Forty-three are enumerated within the United States. The Jesuit colleges are especially notable for the zeal with which they have extended and organized such installations.

Prof. Lawson appeals to the Carnegie Institution to undertake the direction of seismological work in America. At present such work lacks organization, and the seismological stations are badly distributed; they are crowded in some sections and very sparsely distributed in others. The attitude of the government toward seismology is strangely at variance with its general policy in regard to other branches of science. It was proposed a few years ago to equip a number of stations of the Weather Bureau with seismographs, and this proposal was urged upon Congress by a committee of the American Association for the Advancement of Science. As the Bureau has some two hundred regular meteorological stations scattered over the country, manned by paid employees, the additional expense entailed in adding seismological work to its duties would not be considerable, and such an addition would be in accord with the policy of most foreign countries, where seismological observations are generally made under the direction of the official weather services. In spite, however, of the urgent recommendations of the Chief of the Weather Bureau in behalf of this proposal, it was rejected by Congress, and the Bureau possesses, up to date, only the seismograph installed at its central office in Washington.

Another appeal was made to Congress last year to establish a bureau of seismology under the Smithsonian Institution. Although the bill introduced to this effect carried with it an appropriation of only $20,000, it never passed the committee stage in Congress.

It might be supposed that the State of California, after its painful experience of 1906, would be liberally disposed toward the science that has for its practical aim the amelioration of the effects of earthquakes, but such is not the case. It is practically impossible to secure State aid to seismological investigations in California because the commercial spirit of the people fears that such investigations would advertise California as an earthquake region and hurt business.

We are not in a position to say what attitude the Carnegie Institution will take toward Prof. Lawson's proposal that it take over the national control of seismology. Such action would, however, be a departure from the settled policy of the Institution, which is opposed to the assumption of duties that properly belong to the national government. That the study of earthquakes falls within this category cannot be doubted.

The Guardian of Ninety Million Stomachs

Dr. Harvey W. Wiley of the Bureau of Chemistry

By William Atherton Du Puy

BECAUSE one man saw a great light, because he was a great scientist, a great politician, a great philosopher, a great fighter, a great publicity agent, the ninety million have come to have dependable food on their tables three times a day. Because this man lived and fought, the babies of a nation are no longer drugged into degeneracy and death. Because of his activities the adults of a nation are no longer unknowingly acquiring drug habits that sap their vitality. Because of the standard his influence has set in the matter of pure foods and drugs a new spirit is abroad in the land which promises to put all lines of business on a basis of honesty that they have never known before.

For Dr. Harvey W. Wiley, chief chemist of the Department of Agriculture, has so wrought as to bring to bear upon the every day lives of all the people an influence among the greatest of any man of his time. He has a theory that the man of to-morrow is a product of what goes into his stomach to-day. He set out long ago to make better men through giving them better food and preventing the injuries that were being done them through deceptive drugs. He has encountered stupendous difficulties.

And now, suddenly, his enemies execute a coup that was intended to prove his undoing. He is charged with irregularity in the employment of a necessary expert at a salary of $1,600 a year. It is recommended that because of this alleged irregularity all the accomplishments of his thirty years of labor be set aside and that he be summarily dismissed.

But the ninety million have insisted on being heard from. They have arisen *en masse* and have used every organ at their disposal in voicing their displeasure at the proposal to remove the pure food expert. There never was a salary of $1,600 paid to an expert, legitimate or otherwise, that so aroused a nation or promised so many embarrassments to men high in public life.

All this calls particular attention to Dr. Wiley, whose activities have been a matter of comment for a quarter of a century, whose personality has given him a position that is unique, yet whose enemies, though few, are powerful, for the money of all the illicit business he has disturbed is back of them.

Dr. Wiley is an interesting character. His father was an Indiana farmer of Scotch descent who mastered Greek unaided and preached thirty years without pay. His son grew up on a farm and became the champion corn planter of the neighborhood. He paid his way through Hanover College with money he earned doing manual labor on the farm. Later he taught and saved money for a year at Harvard, then taught at Purdue. He became State Chemist in Indiana and in 1882 investigated maple sugar adulterations, one of the first food investigations the United States knew. The following year he was made chief chemist of the Department of Agriculture, a position so obscure that its only duty was passing upon the mixture of fertilizers. This was twenty-eight years ago and with the growth of the Bureau of Chemistry from fertilizer mixing to the supervision of the foods and drugs of a nation has been the growth of Wiley, for he has been the Bureau of Chemistry.

Dr. Wiley is now a man of sixty-eight years of age, a great, hulking man, six feet tall, weighing 220 pounds, in perfect health and apparently twenty years younger than he is.

Soon after Dr. Wiley became associated with the Department of Agriculture he began his pure food investigations. In Indiana had been born an ambition which was nothing less than giving the people of the nation honest food. Everywhere there was deception in the things that were sold. If one bought pepper it was eighty per cent ground up shells. If one bought meat it was "embalmed." If one bought fruit it was pickled in injurious chemicals. If one bought proprietary medicine it might have any amount of opiates in it without his knowledge. There was no dependence to be placed in labels and names. Wherever money was to be made through deception, deception was being practiced. The whole people bought, as food, substances with little nourishment in them. More than that, they were being deceived into putting things into their stomachs that were cryingly injurious to them.

The people did not know this. They were busy with other things and little interested in being told. Even when convinced they did not know what to do about it. They had to be informed, interested, and led to act. It is no mean task to lead the public through these stages. But Dr. Wiley was the man with the particular qualities to accomplish these things. In the first place he was thoroughly aroused over the food question. In the second place he was willing to work night and day, year after year, on this one job. In the third place he had the happiest faculty of the publicity man that has ever been bestowed to an individual.

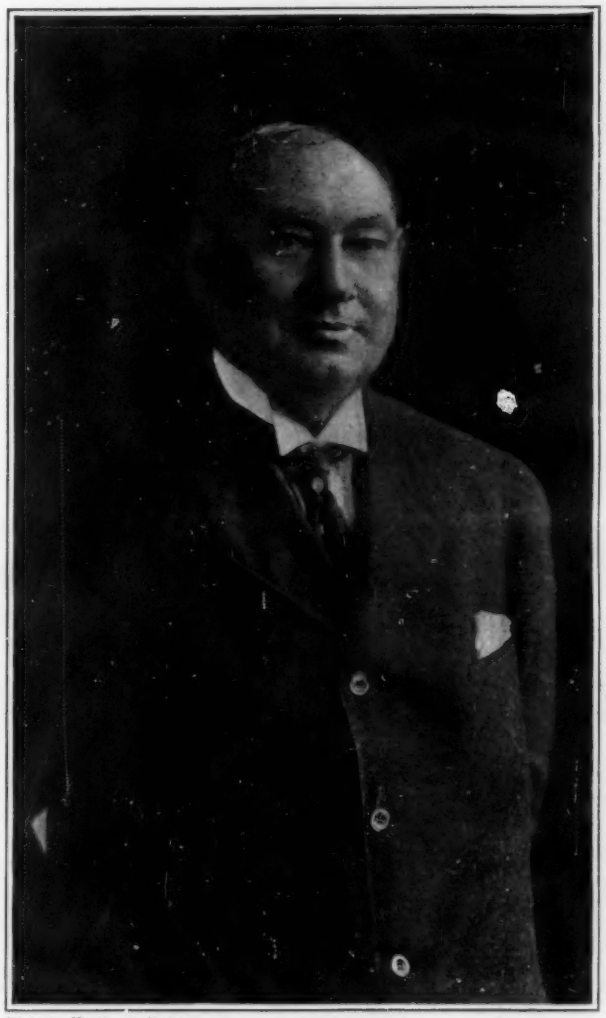


Photo by Harris and Ewing.

DR. HARVEY W. WILEY

The chief of the Bureau of Chemistry of the Department of Agriculture.

Dr. Wiley's greatest asset in his campaign for pure foods has been his ability to get into the papers. He is the most sociable man on earth. He is an artist as an after-dinner speaker. He is a clubman. He accepts many invitations, especially where there is a chance to make an after dinner speech. Then he talks for the newspapers chiefly about pure food. He has the gift of talking in headlines. There is an epigramatic sensation in every one of his speeches. He always makes a "story" that gets on the front page, a "story" that calls public attention to some food abuse. The same is true when he talks to reporters. There is not a newspaper man in Washington who does not fall back on Dr. Wiley whenever he has failed to get something to write elsewhere. It was through publicity that he finally got his message to the masses. They came to know the dangers that beset them through the food they ate, and they came to understand the possibilities of removing these dangers. The campaign of publicity finally ended in the passage of the Pure Food and Drug Act of 1906, which was put in operation under the guidance of the chief of the Bureau of Chemistry on January 1st, 1907.

But with the passage of the law the troubles of the chief chemist were but just begun. Previously his campaign had merely been educational. Now it was administrative. The blacklisting of a given drug or a given food meant the antagonizing of the interests back of that food or drug. Millions had been made in the manufacture of patent medicines that made their reputations for cures by the soothing effects of the opiates they contained. Those millions were to be destroyed by the prohibitions of Wiley. Other millions were being made in an adulteration of various foodstuffs and by their preservation with injurious chemicals. The public was being tricked by the use of dyes and coloring matters. Fortunes were made by branding an inferior article as something better. In the aggregate it is estimated that $400,000,000 in invested capital was arrayed against this one man. That capital was determined to destroy him. His position was political. Big money is prominent in politics. It has long played politics in an attempt to get rid of Wiley.

A trial involving the use of a food preservative was recently held in Indianapolis. Dr. Wiley was refused permission to go to Indianapolis to testify. The court sent a committee to Washington to get his affidavit.

"Do you realize," Dr. Wiley was asked, "that the defendants in this case represent an investment of $10,000,000?"

"Probably so," responded the chief chemist, "but if there was at stake the life of but one baby instead of thousands, I would place that life above the interest of the capital invested."

The Wonderful Mechanism of the Watch

FEW pieces of machinery show more marvelous features than that of the watch. As a general proposition it may be stated that a watch is the smallest, most delicate instrument of the same number of parts that has ever been devised. About one hundred and seventy-five different pieces of material enter into its construction, and upward of twenty-four hundred separate operations are comprised in its manufacture.

Certain of the facts connected with its performance are almost incredible, when considered as a whole. A blacksmith strikes several hundred blows on his anvil in a day and, as a matter of course, is glad when Sunday comes; but the roller jewel of a watch makes every day—and day after day—432,000 impacts against the fork, or 157,680,000 blows during the course of a year, without stop or rest—or some 3,153,600,000 blows during the space of twenty years, the period for which a watch is usually guaranteed to keep good time.

But the wonder of it does not cease here. It has been calculated that the power that moves the watch is equivalent to only four times the force used in a flea's jump. The watch-power is, therefore, what might be termed the equivalent of a four flea-power. One horse-power would suffice to operate 270,000,000 watches.

Furthermore, the balance-wheel of a watch is moved by this four flea-power one and forty-three one-hundredths inches with each vibration, or 3,558¾ miles continuously in one year.

Not much oil is required to lubricate the little machine on its 3,500-mile run. It takes only one-tenth of a drop of oil to oil the entire machinery of a year's service.

Lung Capacity as Affected by Corset-wearing

THE lung capacity of the average woman who does not wear corsets is about 2800 cubic centimeters or 171 cubic inches; of one who is in the habit of wearing corsets only 2,200 cubic centimeters or 134 cubic inches; so that the capacity of the normal and unrestricted lungs is about 27.3 per cent more than that of those which have been compressed by the corset.

The Battleship "Utah"

Our Latest Dreadnought

THE work of upbuilding our modern navy goes on apace. Although the progress is not as rapid as some of us could wish, in quality we are more than holding our own; for what we lack in numbers we gain in gun power and in the high quality of the personnel.

We present an illustration of the latest of our dreadnoughts, the "Utah," which, with her sister ship, the "Florida," now approaching completion at the New York Navy Yard, represents an advance, in many important particulars, on the "Delaware" and "North Dakota." The illustration is from a photograph taken during the recent speed trials of the "Utah" over the Government course at Rockland, when she considerably exceeded her contract speed of 20.75 knots, the maximum average speed being 21.8 knots.

The "Utah" was authorized by Congress on May 13th, 1908. The contract for her construction was let to the New York Shipbuilding Company at Camden, N. J., on November 24th, 1908. Her keel was laid March 15th, 1909. She was launched December 23rd of the same year, and the contract date for her completion was July 24th, 1911. She will probably be delivered over to the Government early in August.

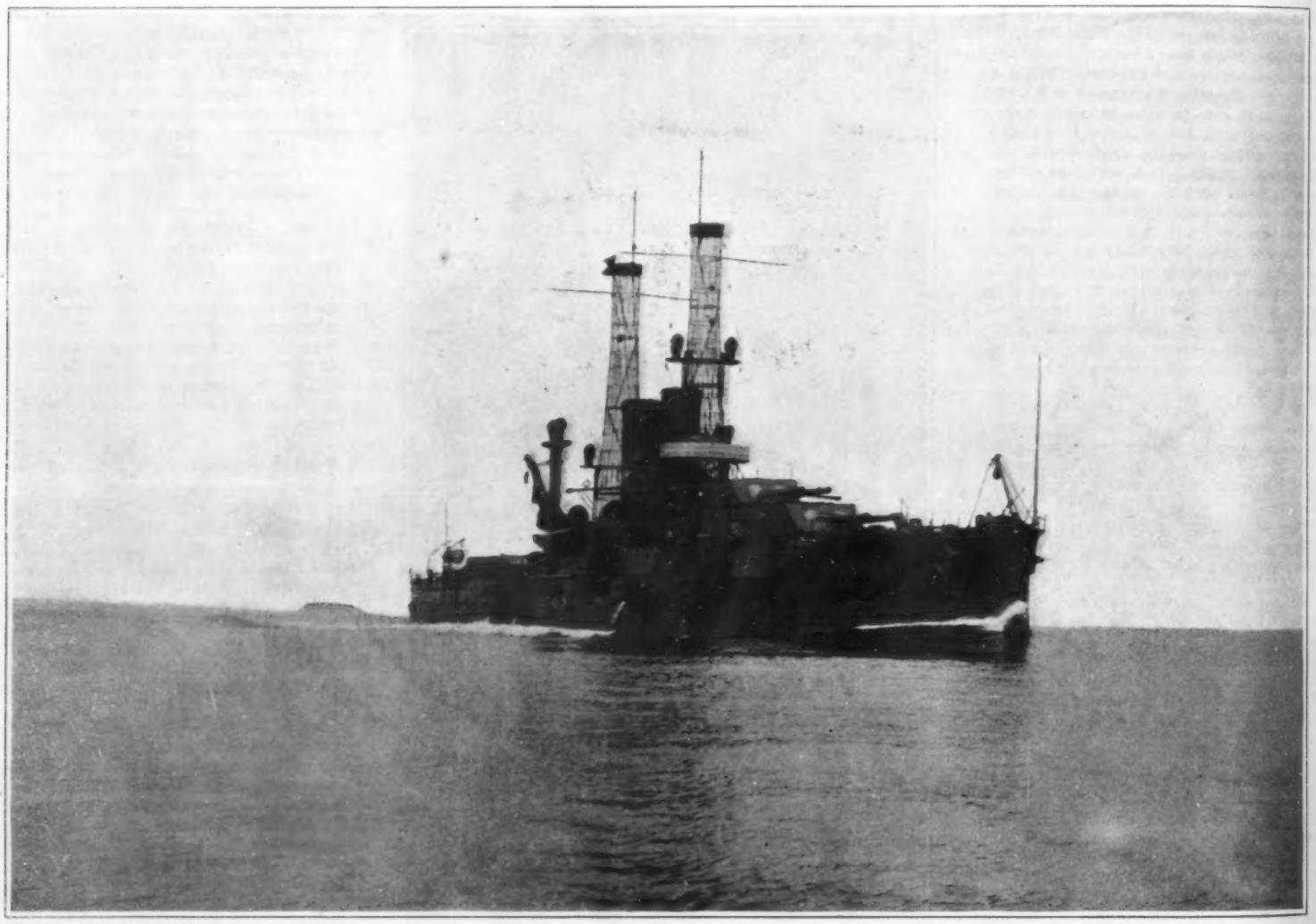
It will be noticed that in her general appearance she conforms closely to the "Delaware" and "North Dakota," having two cage masts, two funnels, and mounting ten 12-inch guns in five turrets placed on the longitudinal center line. Two of the turrets are placed forward of the conning tower, the guns of the after turret firing above the forward turret, the ship being thus able to fire four 12-inch guns dead ahead and through a wide arc of training on either beam. The three remaining turrets are placed aft of the mainmast, the foremost of these three being carried to an elevation sufficiently higher than the after two turrets to enable its pair of guns to fire above their roofs, thus giving a concentration dead astern and through a wide arc of training on each beam of four 12-inch guns. Because of the center line position of all the turrets, the whole battery can be trained through an unusually wide arc on either beam of the vessel.

The "Utah" is 521½ feet in length over all, or about 3 feet longer than the "Delaware," and she exceeds that ship in beam by 3 feet, the "Delaware" being 85 feet 2½ inches broad, and the "Utah" 88 feet 2½ inches. She also draws about a foot and a half more water at her mean draft, which is 28 feet 6 inches. As the result of this enlargement, her displacement at normal draft, when she is carrying two-thirds of the full supply of stores and fuel, and a full supply of ammunition, is 21,825 tons, as compared with 20,000 tons displacement of the "Delaware" when she is carrying two-thirds of her full supply of ammunition and stores. When fully loaded her displacement is 23,033 tons.

The "Utah" is driven by Parsons turbines whose power is delivered to four propellers. The contract called for a speed of 20.75 knots, with 28,000 horsepower, but on trial, as we have seen, she exceeded this by fully one knot. Her bunker capacity is 2,500 tons of coal, exclusive of 400 tons of oil fuel.

The defensive elements of the "Utah" are unusually complete. The main belt is 7 feet 11½ inches wide, extends 6 feet 6 inches below the water line, has a thickness at the top of 11 inches, and at the bottom of 9 inches. The upper belt, which extends to the gun deck, has a thickness of 10 inches at the bottom and 8 inches at the top. The casemate armor is 6½ inches in thickness, and it is associated with 1½-inch splinter bulkheads. The barbettes are protected by 11 inches, and the turrets by 12-inch front and 8-inch side armor.

The battery consists of ten 50-caliber, 12-inch guns, and sixteen 5-inch, 50-caliber guns for protection against torpedo boat destroyers and torpedo boats. There are two submerged torpedo tubes, for the discharge of the new high-speed 21-inch torpedo, which has an effective range of over 4,000 yards. An important feature in these ships is the good command of the guns, due to the sufficient freeboard of the ship. Forward, the freeboard of the "Utah" is about 26 feet, and aft about 18 feet. The guns of the foremost turrets are about 31 feet above the water, turret No. 2 about 38 feet, turret No. 3 about 29 feet, and turrets Nos. 4 and 5 about 23 feet above the water. When the "Utah" goes into commission she will be in command of Capt. W. S. Benson.



Displacement, with two-thirds stores and fuel and full ammunition supplies, is 21,825 tons. **Speed,** 21.8 knots. **Coal,** 2,500 tons. **Oil,** 400 tons. **Armor:** Main belt, 11 to 9 inches; upper belt, 10 to 8 inches; barbettes, 11 inches; turrets, 12 to 8 inches. **Guns:** Ten 50-caliber 12-inch; sixteen 50-caliber 5-inch. **Torpedo tubes,** two 21-inch. **Complement,** 984.

OUR LATEST BATTLESHIP—THE "UTAH" STEAMING 21.8 MILES ON HER SPEED TRIALS

Pigments from Odd Sources

THE ingenuity of the manufacturers of pigments for the use of artists has been so severely taxed within recent years that they have been obliged to employ for the purpose all manner of animal, vegetable and mineral substances. Even Egyptian mummies have been utilized in this way by the manufacturers.

It appears that the corpse of the old Egyptian was preserved in the finest bitumen, and that the remains thus treated in the centuries gone present, on being unwrapped to-day, an appearance quite like that of light-colored leather. Now it has been discovered that, when the bitumen and the leather-like remains are ground down by machinery, there is obtained therefrom a beautiful brown pigment, especially prized by painters of portraits, who claim that this pigment is particularly effective in depicting certain shades of brown hair.

Among the other colors obtained from strange sources may be mentioned Prussian blue. This is made by fusing the hoofs of horses with impure potassium carbonate.

Sepia is the dark fluid discharged by the cuttlefish to render the water opaque for its own concealment when attacked by its enemies.

The cochineal insect furnishes crimson and purple lake and carmine; while ultramarine is procured from the precious metal known as lapis lazuli.

Raw sienna is natural earth from Sienna, and, when burnt, becomes burnt Sienna. Gamboge is the yellow sap of a tree that grows in Siam.

A Sun-dial as an Accurate Time-piece

A Spot of Light That Tells the Time of Day

IN these days of accurate clocks and watches no one thinks of using a sun dial to tell the time of day. At best such an instrument can be right but four times a year, and in many places it can never agree with standard time. Yet the demand for sun dials was probably never greater than it is now, merely because, as an ornament, it adds a quaint and picturesque touch to the lawn or garden, or else it harmonizes well with the architectural treatment of a building. As standard time is obtained primarily from the sun, with due allowances for its variations from noon to noon, there is no reason why a sun dial should not give us accurate time if we make similar allowances.

A novel sun dial in which such regulation can be made is illustrated on this page. This dial differs radically from the common type. Instead of showing the time of day by a shadow cast by the sun, it employs a spot of direct sunlight which is brought to bear upon a hair line on a white screen. The dial of the instrument is tilted according to the latitude, so that it will lie parallel to the plane of the celestial equator. The photograph shows the instrument set for the latitude of New York. The base must be oriented accurately, and the dial face tipped to the latitude of New York (which is about 41 degrees), the upper angle being found by means of the graduated sector on which the dial face is supported. The dial proper is divided into equal divisions to indicate the hours of the day, and opposite the 6 A. M. and P. M. marks are two upright brackets, one of which serves as a screen (at the left in the illustration), while the other contains the perforations through which the sun shines, making a spot of light that falls on the screen. As the face of the dial is parallel with the celestial equator, its edge forms an artificial horizon, along which the sun apparently travels. Because the sun mounts above the celestial equator in summer time, and falls below it in winter, two holes are formed in the bracket at the right, one above the

SUN-DIAL THAT GIVES CORRECT STANDARD TIME

other, so that the spot of light will be sure to strike the screen through one or the other of these holes at any time of the year. In order to allow for variations of the sun, the bracket containing the two apertures is made adjustable in the following manner: On the face of the dial will be noticed a smaller dial marked with the months of the year, while adjacent to it is a scale divided into thirty-one equal parts, representing the days of the month. If the reading is to be taken on, say, February 6th (as shown in the photograph), this small months' dial must be moved to bring the February mark in line with the sixth mark on the scale. An elliptical cam is connected to the months' dial, and engages an arm to which the bracket is connected, thereby shifting the bracket laterally, according to the position of the dial. In February, the sun time is nearly a quarter of an hour slow, consequently the bracket is moved upward or eastward a corresponding amount. This done, the main dial is turned until the spot of light passing through the lower aperture is bisected by the hair line of the screen. The reading of the time is then taken upon a small scale shown at the right in the engraving. This is divided to indicate minutes, and in our illustration the time is shown to be 4:20. When the instrument is first set up the minutes scale must be adjusted so as to harmonize mean local time with standard time. As the sun passes over New York (on the 74th meridian) four minutes before it reaches the 75th meridian, on which New York standard time is based, the minutes scale must be set to read four minutes slow in order that the time as shown by the dial will agree with standard time.

We who live in regions where there are plenty of clocks and timepieces of precision hardly realize the practical value of such a dial. In sparsely settled localities, for instance, on remote plantations, an instrument that will give correct time to the minute, obtaining this time directly from the sun, should be almost indispensable.

Casting Cement Building Walls on the Ground

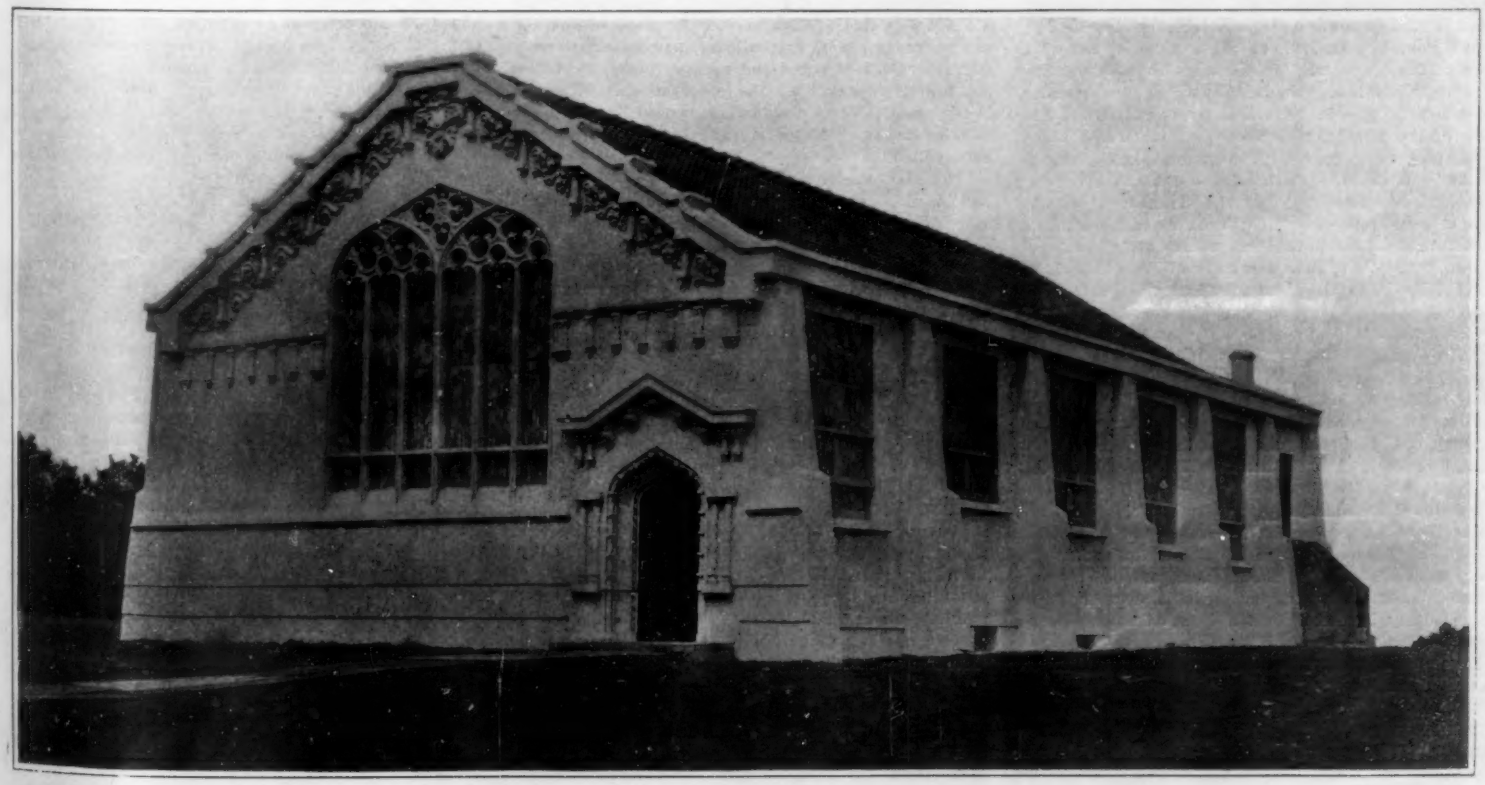
A Church Built in a Novel Way

THE accompanying illustrations show a method of a new system of reinforced concrete building construction, in which the church walls are erected by means of raising jacks.

On the foundation wall and on piles inside of the building lot are set a series of jacks made of steel. These jacks consist of a supporting carriage, a pivoted walking beam, and a collapsible screw driven by a worm gear and worm. A platform is laid on the jacks and on this platform are set in their proper relative positions, all door-frames, window-frames and other openings. The concrete is poured around the opening thus established. The reinforcement is easily and properly placed horizontally and vertically, because the wall resembles a great draughting board and is very readily "laid out." The entire wall is poured at once, which can be done in a single day, even though the wall be 200 feet long and three stories high. After the wall is finished, it is allowed to set for forty-eight hours; then a small gasoline engine or electric motor is connected with the driving shaft, and the wall rises from the inside slowly and quietly to its permanent vertical position.

When all the walls are in place the corners where reinforcements from either wall project and interlock are poured, and we have a complete, monolithic, well finished structure. Floors and roof of concrete or of any construction desired are put in place in the same way as in any other building.

No forms are used whatsoever in this wall construc-



THIS STRUCTURE WAS BUILT IN SECTIONS FLAT ON THE GROUND

tion except the wooden jack platform, which is never destroyed, but is used over and over again. An air space can be made merely by filling in with loose sand, which is rodded out when the concrete sets and the wall is partially raised. The reinforcement is placed both horizontally and vertically exactly where it belongs in both inner and outer wall. It is possible to use rods, fabric or any other kind of reinforcement without the slightest difficulty.

An Airman's Weather Bureau

DO YOU remember how, in Kipling's "With the Night Mail," the Mark Boat flashes news of the wind and weather along the several "levels," so that the aerial liners may take advantage of favorable currents, and avoid the besetting dangers of the sky so graphically described in the same prophetic tale? It was only yesterday that Kipling dreamed his dream—of "the year 2000"—and to-day we stand upon the threshold of its realization.

Not to dogmatize about the future and assert that the airman will always be more at the mercy of the elements than the seaman, and that consequently the cultivation of aerial meteorology will be more urgently imposed upon our posterity than that of maritime meteorology is upon our contemporaries, we are safe at least in declaring that in the year 1911 such is decidedly the case. The sea has been robbed of nearly all its terrors. Even *mal de mer* is an anachronism and a solecism on a "Mauretania" or "Olympic." The dangers of the air are not yet even half appreciated.

To the meteorologist, already burdened with the heavy responsibilities imposed upon him by the mariner and the farmer, the producer and the transporter of perishable goods, the seeker of health and the seeker of pleasure, has suddenly been assigned the twofold task of charting the aerial ocean and giving the aeronaut timely warning of its dangers.

That meteorology is even now ready to enter upon its new duties is the confident belief of Dr. Richard Assmann, director of the Royal Prussian Aeronautical Observatory of Lindenberg.

The noble institution over which Dr. Assmann presides—situated some forty miles southeast of Berlin—was fully described in the SCIENTIFIC AMERICAN SUPPLEMENT of July 13th, 1907. It has been, ever since it was founded, the heart and brains of "aerology" in Germany; its contributions to meteorology have been almost epochal; but its enormous practical significance to aeronautics has only recently begun to be realized.

In a long article on "The Dangers of Aerial Navigation and the Means of Diminishing Them," contributed to the *Deutsche Zeitschrift für Luftschiffahrt*, Dr. Assmann a few months ago described, among other things, the aeronautical weather service that he was then organizing, and which, with Lindenberg Observatory as its center, is now in full operation. Dr. Assmann's account of his new undertaking is summarized in the following paragraphs.

It should be stated at the outset that at least three tentative schemes of this sort had previously been put into execution in Germany, though on a relatively small scale. The first was undertaken by Lindenberg Observatory in 1907, on the occasion of the trial-trips of the "Parseval;" observations of the upper air-currents were made simultaneously at five stations by means of pilot-balloons and communicated to the crew of the airship, who were thus materially aided in shaping their course. The second similar undertaking was Dr. Linke's special weather service for aeronauts in connection with the aeronautical exposition at Frankfort—the "Ila" (I. L. A., Internationale Luftschiffahrts-Ausstellung)—a notice of which appeared in the SCIENTIFIC AMERICAN of June 18th, 1910, pp. 511-512. The third aeronautical weather service was organized by Dr. Polis, at Aachen, and is still in operation. It is intended especially for the benefit of the many aero clubs of the Rheinland, but its utility was conspicuously demonstrated during last year's army maneuvers in West Prussia.

These local and quasi-experimental undertakings have paved the way for a national aeronautical weather bureau. For the moment its field of operation is northern and central Germany—i. e., Prussia and the states that are especially under Prussian influence—but its extension to the remaining German States will follow as soon as the wheels of diplomatic machinery have performed the requisite number of revolutions. Political heterogeneity still hampers imperial undertakings in Germany to a degree that Americans find it difficult to realize.

If we examine the facilities available for the proposed extension of the domain of practical meteorology to the upper air, we find that Germany is much better prepared for such an undertaking than the other European states. Four years ago the Prussian Government decided to infuse new life into its weather service, especially with a view to the requirements of agriculture. The Ministry of Agriculture, Domains and Forests established in Prussia and the neighboring states, independently of the previously existing meteorological institutes, a network of seventeen forecasting and map-publishing weather stations, modeled, in a large measure, after those of the United States Weather Bureau. Dr. Börnstein, of Berlin, was a leading spirit in this undertaking, and Dr. Polis, of Aachen, spent two months in the United States, inspecting the methods and *matériel* of the American weather stations. Germany's new Public Weather Service is now in vigorous operation, and represents an intensive application of the methods of applied meteorology that is hardly paralleled elsewhere outside of the United States.

In the summer of 1909 the writer of this summary paid a visit to Dr. Hergesell, president of the International Commission for Scientific Aeronautics, at Strasburg. This distinguished aerologist was even then urging the equipment of the Public Weather Service stations with pilot-balloons, in order that daily observations of upper-air currents might be secured at many points throughout the empire for the information of forecasters. It is, however, significant of the mode in which scientific ideas unfold themselves, step by step, that in the course of a half-hour's conversation on this subject Dr. Hergesell never once suggested the advantages that the adoption of his project would offer to aeronauts—notwithstanding the fact that he is an aeronaut himself and had at that time made several voyages with Zeppelin. So far as the writer can recall, his point of view was entirely meteorological; the forecasts that he hoped to improve were those applying to land and sea; and certainly the same may be said of his writing at that period, as well as those of Querpain, Schreiber, Kremser and the other enthusiastic advocates of the pilot-balloon.

The hopes of Hergesell are now being realized, but the point of view has shifted. Lindenberg Observatory has now equipped the Public Weather Service stations with the apparatus needed for daily observations of the upper air; not primarily for the purpose of improving the regular weather forecasts, but in order to secure the means of lessening the dangers of aerial navigation—dangers, in Assmann's opinion, largely avoidable, which cost twenty valuable lives in Germany during the year 1910 alone. To-day the aeronaut launches his craft with no more knowledge of the meteorological conditions in the upper air than can be vaguely surmised from those depicted in the ground-surface weather map. To-morrow he will have a weather map all his own, representing, as a rule, quite a different set of conditions from those prevailing at the lower level.

The details of the plan by which this desideratum is being accomplished can best be stated in its originator's own words. We quote from his memoir, referred to above, which was written a few weeks before the new service began its work.

"A number of the Public Weather Service stations, or better, if the cost does not prove too great, all of these stations in northern and central Germany, are to be furnished by the Lindenberg Observatory with a theodolite, an inflating-balance for determining the ascensional force of the balloons, a sufficient number of rubber balloons, and the necessary graphic tables for rapidly working up the observations. Where it is not practicable to provide compressed hydrogen gas in steel tanks, a Nass-Gradenwitz gas-generator will be supplied.

"The stations will be expected to send up a pilot-balloon at 8 A. M. on every day when the weather and state of the sky are favorable, and to follow its course with the theodolite as long as possible. The observation will then be worked up—a matter of barely a quarter of an hour for a practised observer—and telegraphed in cipher to Lindenberg. Here the observations received from all the stations will be assembled, and redistributed, in a single telegram, to each of the co-operating stations, where, if they arrive in time, they can be utilized in connection with the ordinary daily weather forecast, as well as in preparing special forecasts and warnings for aeronauts. At Lindenberg the regular observation with a kite or captive balloon is made daily at 8 A. M., and in summer an observation is also made about 5 or 6 A. M. These furnish not only data concerning the wind such as are obtainable with a pilot-balloon, but also data of the other meteorological elements. It is also proposed to make a daily observation at Lindenberg with a pilot-balloon at 11 A. M., and whenever circumstances require another about 2 P. M., so that soundings of the air up to an altitude of several thousand meters will be made three or four times daily within a period of from six to nine hours, affording valuable information as to rapid changes in the upper atmosphere. It is hoped that it may be found practicable also to make a midday observation at some of the other stations; especially at the kite-station of the Deutsche Seewarte, at Hamburg, which is already well equipped for such work.

"It is altogether likely that the Public Weather Service stations will be supplemented with stations especially erected for the purpose at the larger aviation fields, airship sheds, and the like. One of these has already been assured at Bitterfeld. Another important addition to the aerological *réseau* will be the 'Aeronautical Observatory on the Inselberg,' near Gotha, the erection of which has been intrusted to the authorities of Lindenberg Observatory by the Duke of Saxe-Coburg-Gotha, and which will be installed next spring. There is also a prospect that the long-promised aerological station on the Taunus will soon be erected, and will contribute its part to the new service. Lastly, aerological stations will probably be installed at certain nautical schools on the coast, thus providing observations from a region that is particularly dangerous to the aeronaut.

"While pilot-balloons afford the easiest and cheapest method of exploring the upper air, they labor under the serious disadvantage that they cannot be used in foggy weather, or even when the clouds hang very low. During the winter months, especially, one cannot count upon obtaining observations by this method up to one or two thousand meters more than about half the time. This of course applies especially to an early morning observation, at a fixed hour; toward midday there is a better prospect of clear sky, especially if one is on the alert to take advantage of occasional breaks in the clouds. As a measure of economy, the stations will be supplied with balloons of two sizes; the smaller and cheaper to be used when it is evident that the state of the sky will not permit the balloon to be followed with the theodolite to a great distance. In special cases it may be possible to make observations at night by the use of the illuminated balloons manufactured by Saul of Aachen; this method, however, is relatively expensive.

"There will, however, undoubtedly be many days on which few if any observations can be secured with pilot-balloons, and observations will be available only from stations equipped with captive balloons and kites. In order to meet this serious difficulty, the Lindenberg Observatory is considering the plan of supplying a few selected stations with a simple and easily manageable kite-outfit."

This plan leaves to be considered only the relatively infrequent case of cloudy or foggy weather combined with a calm air, in which a kite could not be raised. The obvious way out of this difficulty, if the expense did not forbid, would be to further equip the stations with captive balloons, carrying self-registering apparatus. However, Dr. Assmann admits that such an expedient must be relegated to "a happier future."

The plan outlined above was approved by the German Government and, in its main features, went into operation January 2nd, 1911. Funds have subsequently been granted that insure the continuation of the enterprise at least until April, 1912. The service is being used to the fullest extent by the many aeronautical societies of Germany, and is adapting itself to practical requirements in various ways not contemplated in the original programme. Thus it is interesting to notice that special arrangements were made for supplying meteorological information to the participants in the great "Rundflug" of June 11th to July 7th; two officials of the service were detailed to accompany the fliers, and to make frequent observations of the upper air-currents, with pilot-balloons, at the beginning of each stage of the course; and all stations were expected to make and telegraph aerological observations three times a day during the period in question.

It is hoped that the field of observation will soon include the South German States; especially as this would bring to the enterprise the valuable co-operation of the so-called "kite-station" at Friedrichshafen, on Lake Constance, which is really a "balloon-station," as the wind over the lake is rarely strong enough to raise a kite, even though aided by the motion of the small steamboat from which the apparatus is flown, and much the larger part of the daily observations are made with captive balloons. One of Dr. Assmann's cherished plans is the erection of a similar "floating kite-station" on Danzig Bay, as an appendage to the Lindenberg Observatory.

The founder of the aeronautical weather service realizes that his plan is open to the objection applying to weather services generally; viz., it cannot hope to provide detailed information and forecasts of local conditions except in so far as these may be inferred from the general outlook. To revert to Kipling, one of the gravest situations in which the aeronaut may be placed arises "when the Heavens are balancing their volt-accounts;" and to forecast the occurrence and movement of a thunderstorm from the observations of a few widely separated stations is a well-nigh hopeless undertaking. Is it feasible to secure a corps of

special thunderstorm observers reporting by telegraph and telephone large enough to enable the forecaster to follow the progress of these disturbances across the country and give timely warning to the aeronaut to get out of their path—possibly using wireless telegraphy for transmitting the warnings? Dr. Assmann thinks so and has even made a detailed estimate of the probable expense. However, this is not part of the programme definitely formulated for Germany's "airman's weather bureau."

SPECIAL WEATHER SERVICES FOR AERONAUTS.

In Germany it has become the regular practice to organize a special meteorological service in connection with every important aeronautical competition. Some of these special services, as well as the permanent general service recently organizd by Assmann, have already been described in the SCIENTIFIC AMERICAN. The most important undertaking prior to Assmann's was that of Dr. Franz Linke in connection with the Frankfurt aeronautical exposition of 1909.

The *Deutsche Zeitschrift für Luftschiffahrt* describes the weather service recently operated in connection with the German reliability flight in the upper Rhine district. A meteorologist traveled over the route with the contestants, making observations and issuing forecasts at each stopping-place. Three principal lines of work were carried out, viz: (1) The telegraphic weather reports of the Deutsche Seewarte were received and twice-daily forecasts were issued of the weather along the route. (2) Each day, before the flying was resumed, the movement of the upper air was observed locally by means of pilot-balloons; the general behavior of the upper currents over Germany was determined from telegraphic reports of similar observations made at the fifteen regular pilot-balloon stations operating under the Lindenberg observatory; and the wind at the surface was measured with a portable anemometer. (3) A special thunderstorm service was in operation. Sixty observers, distributed over southwestern Germany, sent in an "urgent" telegraphic report whenever thunderstorms approached their respective localities. This service proved to be especially efficient and useful; several thunderstorms occurred and the aeronauts were warned, at least an hour in advance, of the arrival of each of them.

Freezing Experiments on Fish and Other Animals

SOME remarkable experiments were made not long since at the University of Geneva by M. Raoul Pictet, whose name is intimately connected with the production of artificial cold. He was, in fact, one of the pioneers in this field, which has now taken so wide a development. In the course of some recent work he was able to take live fish, such as goldfish and many of the fresh water varieties with which we are familiar, and place them in a tank. Then he freezes the water in which the fish are swimming, so as to form a block of ice. Then he freezes the ice block still further, down to a low temperature, about 20 deg. C. below freezing point, and keeps the whole at this point by means of a freezing apparatus for two or three months. After this time the block of ice is thawed out very slowly, and the seemingly dead fish come to life and swim about as usual.

This is the simple but most remarkable experiment which M. Pictet realizes, adding a new discovery to the important ones he has already made. However, these latter relate mainly to industrial processes, while the present experiment is one of far-reaching interest to science in general. In a recent interview with the *Matin*, of Paris, M. Pictet states that his first experiments upon life at very intense cold date nearly eighteen years back. He became convinced that if the chemical reactions of a living organism could be suspended without causing any organic lesion, the phenomena of life would disappear, but these would come back as soon as the organism was restored to the usual conditions. Great cold will suspend the operations of life as far as we are able to observe, but without losing it totally. He made some very conclusive experiments upon fish, as we already noted, and these could be completely frozen and then thawed out without causing loss of life. On one occasion, while working on this subject at the university, he put twenty-eight fish in a deep glass basin, and left them for twenty-four hours in water at about the freezing point. Then he froze the water to a solid block, together with the fish, going down to 20 degrees. By breaking off part of the block, one of the fish could be taken out, and he found that it could be broken in small pieces just as if it were made of ice itself. After thawing out the block, it is found that no harm has been done the fish, and they swim about just as if nothing had happened.

The freezing must not be carried down too far in the case of fresh water fish, and the temperature indicated above is about the lowest which can be used, otherwise the fish will be killed. However, there are other animals which can stand a much greater amount of cold. Frogs come next in order to fish in this respect, and can be frozen down to 28 deg. C. below the freezing point. Some water lizards or salamanders will stand more cold, or 50 degrees. He finds that snails will resist the greatest amount of cold among the specimens which he tried, and they can be frozen as low as 120 deg. C. below the freezing point, and will then come back to animation.

Correspondence

The Invention of Artificial Rain Apparatus

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of April 15th, 1911, there appears an article on the production of artificial rain for agricultural purposes, in which article certain rain-producing apparatus is described, the invention of which is credited to a German whose name is given as Hartmann.

Permit me to call attention to the fact that the system of rain producing described in your article, which I notice is credited to the German periodical *Prometheus*, is my invention, and that I have secured the following patents on it:

	Patents No.
British	9,034
Australia	15,376
United States	958,937, 963,932
France	403,701
Belgium	211,923
Argentine Republic,	5,684, 6,392, 6,642, 7,170, 7,171, 7,944, 7,949, 8,292
Brazil	5,651
Chile	2,215
Uruguay	412, 474

Including four German claims now pending in the Imperial Patent Office in Berlin.

I write this letter in order that any wrong impression that may have been created by the article from *Prometheus* may be removed.

New York city. EMILIO OLSSON.

The Difference Between Light and Heavy Winds

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of May 20th, page 507, of the SCIENTIFIC AMERICAN, under heading, "Home-made Anemometer," the formula to obtain true velocity of wind is

$$P = 0.400 - \frac{B}{30} S V^2.$$ Shouldn't this read $$P = 0.004 - \frac{B}{30} S V^2?$$

Would you please inform me just where you draw the line between light winds and heavy winds?

Pittsfield, Mass. P. N. MOORE.

[Our correspondent has very properly called attention to an unfortunate typographical error in the article referred to. The factor 0.400 was a misprint for 0.004.

We may add that the factor $-\frac{B}{30}$ (correction for barometric pressure) can safely be neglected when the place of observation is near sea level.

The choice between the larger and the smaller windplates must be decided by the observer's experience in the use of the instrument. It will depend, of course, upon the strength of the spring and the length of the scale, as well as upon the force of the wind.

The whole subject of normal pressure-plate anemometers, and the various forms of such apparatus (the earliest of which dates back to the year 1724) will be found fully discussed in C. Abbe's "Treatise on Meteorological Apparatus and Methods," which was published as an appendix to the Annual Report of the Chief Signal Officer for 1887.

It is hardly necessary to state that the rough-and-ready instrument described by Mr. Gilbert should, whenever possible, be compared with a standard anemometer—or, more conveniently, a Richard anemocinemograph, which shows the velocity of the wind directly, at a given moment—and its error thus determined.

Having obtained a fairly accurate instrument, it should be further borne in mind that the velocity of the wind near the earth's surface is nearly always very much less than that prevailing at the altitude of an ordinary aeroplane flight; and that the existing statistics of the variation of winds with altitude are mere averages, subject to wide fluctuation. On the whole, the anemometer is, as yet, of but moderate utility in aeronautics.—ED.]

Self-luminous Night Haze

UNDER the above title Prof. E. E. Barnard, of the Yerkes Observatory, publishes in the *Proceedings of the American Philosophical Society* an important contribution to the subject of nocturnal sky-light. His paper is especially interesting for the reason that, at the time of writing, the author appears to have been unacquainted with the publications of Yntema, Maurer, and other Europeans on the so-called "earth-light," a brief account of which was published in the SCIENTIFIC AMERICAN, Nov. 19th, 1910, p. 394. Barnard's observations confirm and supplement those of his European confréres.

On moonless nights the sky is often more or less distinctly luminous, and this luminosity cannot be wholly attributed to the diffusion of the general starlight by moisture in the air. At times the illumination is so great that the face of an ordinary watch can be read by it. There seems to be no doubt that this luminosity is of an auroral nature, as it has been shown that the spectrum of the aurora is essentially always present on a clear dark night. In describing this phenomenon the author merely corroborates the observations of several earlier writers, but he proceeds to describe a particular manifestation of this luminosity—or possibly a phenomenon distinct therefrom—to which attention does not appear to have been previously directed.

This consists of strips and patches of luminous haze, which have been observed at Yerkes Observatory several times during the past year. It is not confined to any particular region of the sky nor to any hour of the night. It always has a slow drifting motion among the stars, comparable to that of ordinary hazy streaky clouds that are often seen in the daytime The streaks are usually straight and diffused, and as much as 50 degrees or more in length, and 3 degrees to 4 degrees or more in width. In some cases they are as bright, or nearly so, as the average portions of the Milky Way; i. e., they are decidedly noticeable when one's attention is called to them. They are apparently about as transparent as ordinary haze. Sometimes, when seen near the horizon, where they may be rather broad, they have strongly suggested the "dawn" or glow that precedes a bright moonrise. Their luminosity is uniformly steady.

The writer believes this haze to be something quite different from the noctilucent clouds that were seen for several years following the eruption of Krakatoa, but only during the short nights of summer; whereas the haze has been seen through last autumn and winter. The noctilucent clouds, with which Jesse's name is always associated on account of his indefatigable study of them, were pretty conclusively shown to consist of fine volcanic dust, floating at so great an altitude (upwards of 50 miles) as to receive and reflect the light of the sun long before and after the ordinary clouds. Prof. Barnard believes what he has seen to be ordinary haze, in some manner rendered self-luminous. In one instance he watched strips of this luminous substance from before dawn until, as the daylight killed their luminosity, they were seen to be strips of ordinary haze.

Meteorologists who read Prof. Barnard's paper will undoubtedly be reminded of the references that are occasionally made by students of clouds to "auroral cirrus;" for although the author throughout his paper speaks of "haze," he is evidently referring to cirrus or cirrostratus clouds—which are quite distinct from haze in the usual meteorological sense. Cirrus seen in the daytime often simulates the forms of the aurora, and that there may be some connection between the two phenomena has often been suggested.

A Lake with a Roof

THE great salt lake at Obdorsk is nine miles wide and seventeen miles long, yet except in a few places it is solidly roofed over with a deposit of salt which is becoming thicker and thicker each year.

About the middle of the last century salt crystals first began to gather upon the surface of the water. Year by year, owing to the evaporation of the water, the crystals became more numerous, and then caked together until this great roof was formed. In 1878 the water beneath this salt-crystal roof found an underground outlet into the Obi River. This lowered the lake's surface about three feet leaving that distance between the water and the roof, and each year this distance has been diminished by the constant addition of salt crystals to the roof.

Many springs surround this lake. Their water flows over the roof and evaporates there, and thus continually adds to its thickness. After many years the springs will probably become choked with their own deposits, and then the whole will become covered with earth, so that a great salt mine will be formed—a treasure for the Siberians hundreds of years to come.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Studying the Anarchists' Bomb Scientifically

THE "bomb" laboratory described below is not a place in which bombs are made. No layman has yet penetrated into the secrets of the manufacture of bombs for military use, so that there is nothing to be said on that subject. More is known of bomb factories of another sort, which are operated by criminals; but it is not advisable to describe these establishments, lest the description fall into the hands of some person who might be tempted, either by malice or by simple curiosity, to engage in the manufacture of bombs. The bomb laboratory, the description of which is here quoted from *Reclams Universum*, is operated by the police of Paris for the purpose of investigating and destroying bombs found in the city. It has served as the prototype of similar establishments in other cities.

The progress of chemistry continually makes the path of the transgressor more hard. The slightest trace, even a drop of blood no larger than a pin's head, may suffice to convict a murderer. The impression made on a cartridge by the hammer of a pistol, or a single hair found on the clothing of the suspected person, may serve as valid proof of crime. Until recently, however, science has been almost powerless against the pernicious activity of the bomb-thrower. When a bomb explodes, it is shattered into thousands of minute fragments, and its contents are resolved into gases which cannot be caught and investigated. The effectiveness of bombs depends upon the fact

A bomb with a three-hour fuse.

that they are filled with substances which, when ignited, evolve enormous quantities of gas in a minute fraction of a second. The explosive force of this suddenly evolved mass of gas is enormously increased by the very high temperature to which it is heated by the accompanying chemical reaction. Hence, a bomb which can be carried in the pocket is able to produce terrible devastation.

Nevertheless, the bomb thrower is sadly deceived if he believes that an exploded bomb leaves no trace because its whole contents are converted into gases and because the shell is made of an old gas pipe or tin can, fragments of which would convey no special information leading to the identification of the criminal. It was difficult indeed for chemists to devise methods of discovering the secrets of shattered bombs, but even this difficulty has now been surmounted. This is proved by the recent trial of one of the criminals who attempted to blow up the Municipal Building in Friedberg, in order to rob an adjacent bank in the resulting confusion. These same criminals had previously attempted to extort money by threatening letters from a wealthy banker in Frankfurt, and, in order to intimidate him, had placed a bomb in front of his residence. Although the bomb exploded according to the design of the criminals, it nevertheless was the cause of their undoing. The walls of the house were examined very thoroughly, and a few small fragments of the contents of the bomb, which had been thrown out before the flame reached them, were found. These few particles of the explosive mixture, in connection with some other evidence, sufficed to prove with certainty that the bomb had been filled with blasting gelatine. Here was one point gained, and a second resulted from the careful examination of the fragments. Blasting gelatine is made by a great many factories, which differ in their processes and in the composition of their products. It was proved with certainty that the blasting gelatine found in the wall had been made in a factory at Saint Ingbert, from which it had recently been stolen. This was sufficient to identify the criminal completely, because only one person could have been guilty of the theft. In a similar manner the composition of the bomb which exploded in 1907 before the police station in Offenbach

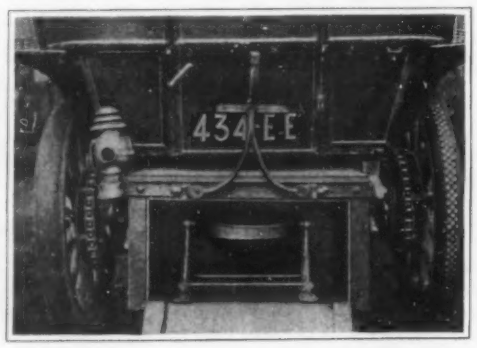
The Paris bomb laboratory.

was determined from a few fragments. In this case a lead tube had been filled with a rather common explosive mixture; but it was found possible to discover not only the character of the mixture, but also the mechanical construction of the bomb.

Very much more dangerous than burst bombs are those which for any reason have failed to explode. Here it is not only necessary to examine the bombs in order to identify the criminal, but it is first of all requisite to make them harmless. This is a rather difficult matter. Some bombs are so constructed that they explode instantly upon the slightest shock or as soon as an attempt is made to disturb their position. The most important of these bombs are those in which the explosion is brought about by means of a liquid contained in a glass tube. The bomb is usually so contrived that the slightest displacement causes a weight to fall upon the tube and break it, so that the liquid escapes and comes in contact with substances which, under its action, explode with great violence. These bombs are perhaps the most dangerous of all, and the methods which are commonly assumed to be proper for the destruction of bombs—immersion in water, for example—are powerless against bombs of this character, which explode in water as well as in air.

Bombs which are exploded by fuse are much less unpleasant to handle, both for the policemen and the bomb throwers, who in many cases have been killed by the premature explosion of bombs of the other type. Usually, however, the glass tube containing the exciting liquid is lowered carefully into the bomb after the latter has been placed in position.

The fuse employed for the ignition of a bomb is usually very long, so that the criminal has plenty of time to escape, and even to accomplish a railway journey of several hours before the bomb explodes. The fuse consists usually of a train of sulphur or a cord saturated with sulphur. From the time which a measured portion of this cord occupies in burning, the length of fuse required for any desired interval between ignition and explosion can be calculated with accuracy. The bomb shown in the illustration, which



Automobile with a safety bomb carrier.

was found in Paris on a window sill, was provided with a fuse which would have occupied three hours in burning. It would be a great mistake, however, to simply quench or tear out a burning fuse and then freely handle the bomb, for many dynamiters are ingenious enough to attach fuses to the more dangerous bombs of the liquid type in order to mislead the finder in this very way. All bombs, therefore, whether provided with fuses or not should be handled and examined in the careful manner described below.

In the first place, the bomb must be removed safely from the city to the laboratory in the suburbs. For this purpose it is seized with very long tongs of peculiar construction, and slowly and carefully removed, without changing its position with respect to the horizon, from the house or other place in which it is found, to an automobile provided with a safety bomb carrier, which is simply a box supported on gimbals like a compass. Such an arrangement is called a Cardan suspension, from the name of the Italian physicist, Cardono, its alleged inventor. In reality, however, the device was invented by Leonardo da Vinci, as has recently been demonstrated by Dr. Otto Werner. The Cardan or gimbal suspension is used in all cases where it is necessary to keep a body perfectly horizontal. It consists of two concentric rings which can turn on axes lying in the planes of the rings and at right angles to each other. The body to be kept level is attached to the inner ring.

When the bomb has been safely placed in the carrier the most difficult part of the work has been accomplished. The automobile then proceeds very slowly and cautiously to the bomb laboratory, and any small shocks which it experiences are prevented from affecting the bomb by the Cardan suspension.

The bomb laboratory of Paris is situated in the suburb of Vincennes. The bombs are destroyed in a shed constructed of light boards and surrounded by

Hydraulic press for crushing bombs.

a wall of earth and an outer and high wall of masonry. If a bomb explodes, the surrounding country, which is a waste and uninhabited land, is thus protected from injury. This precaution is not unnecessary, for stones have been thrown more than a mile by the explosion of a bomb. If the Paris laboratory should be destroyed by a bomb, the light boards would be shattered into still lighter fragments, whose flight would soon be stopped by the resistance of the air. For additional precaution, the building is open at the upper part immediately under the roof, so that the pressure of the exploding gases cannot become very great. The shed is also surrounded by a board fence, at one corner of which stands a sentry box which is always manned. Inside of the fence and outside of the earth wall is situated a workroom containing a collection of bombs and fragments of bombs, with apparatus for the examination of bombs. Here, also, is the pump cylinder of a hydraulic press which is connected by a subterranean tube with the press cylinder in the bomb shed, inside the earth wall. The bomb is removed from the automobile with the greatest care and placed upon the piston of the press and below the fixed headpiece. The men then retire to the outer workroom and the press is set into operation. As the piston rises the bomb is crushed. It has been proved by experience that the safest method of opening bombs is by crushing in this manner because all parts of the bomb are left undisturbed, and because the shell is usually cracked before the glass tube is broken. If an explosion occurs the gases can escape through the broken shell without doing much damage, as they encounter little resistance at this point or in the open shed, so that the contents of the bomb are quietly consumed, leaving sufficient traces for the determination of the composition of the mixture.

It is evident from this description that the warfare between the chemist and the dynamiter is not without interest, and that it is waged with mental weapons in

the full sense of the word, despite the employment of the rather crude, mechanical aids which have been described. It is especially gratifying to find that in this difficult field the criminal has been conquered by science.

A Flexible Steering Column for Automobiles

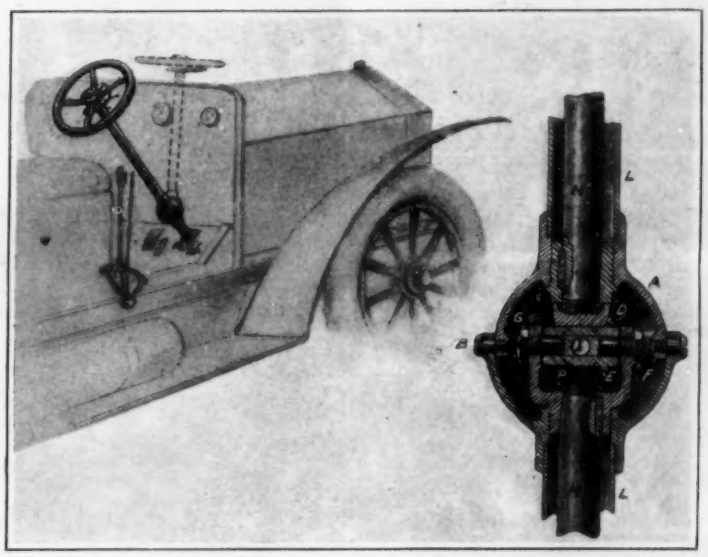
WITH the low and elongated automobile bodies that have recently come into favor the steering column is necessarily placed in a very oblique position. This construction is both inconvenient and dangerous, for when the driver has insinuated himself into the narrow space between the steering column and the seat he is completely imprisoned and immobilized by these parts, by the levers at his right and by the passenger at his left, whom he must disturb in order to leave his seat. If the car is suddenly stopped by a collision, the driver is projected violently forward and is seriously injured by the steering wheel.

A French inventor named Martinot has patented a steering column which can be bent forward sufficiently to permit the driver to mount and dismount easily, even on the right side, and which bends forward automatically in case of sudden stoppage, so that the driver is thrown clear of the car, instead of being crushed by the steering wheel. The description and illustrations of the apparatus which are here given are taken from a recent issue of *Cosmos*.

The steering column is made in two parts, *MM*, which are connected by a universal joint *I* (Fig. 1), of simple and massive construction, which does not impair the strength of the column. The movement of the upper part of the column is confined to a fore-and-aft vertical plane by two hemispheres *AA'*, which are attached respectively to the tubes *L* and L_1 inclosing the fixed and movable parts of the column, and which together form a hinge joint, turning on the axis at *B'*. The fixed and movable parts of the column are securely fastened to the cross of the universal joint by pins, in addition to the screw-bolts *GF*, etc.

The two extreme positions of the steering column are shown in Fig. 2. The angle of displacement is limited by a stop, which is adjusted in accordance with the space available in each vehicle. The movable part, in consequence of its weight, naturally assumes the normal position, in line with the fixed part, and the pressure exerted on the wheel by the driver's hands, tends to hold it firmly in this position. The inventor claims that the wheel cannot be thrown forward by vibrations of the car or inequalities of the road, even at the highest speed.

As the two parts of the column, however, are connected by a universal joint, the apparatus works perfectly in any position. It may, therefore, be modified by the addition of a second stop so that the two parts of the column are never in line, but form with each other, even in steering, an angle determined by the convenience and preference of the driver.



Redrawn from *Cosmos*.

FLEXIBLE STEERING COLUMN FOR AUTOMOBILES

Why Europe Is in Advance of America in Pioneer Inventions

THE discussion which was recently started in the columns of *Engineering News* on the subject of Europe's superiority in the matter of pioneer inventions has called forth, among other letters to the editor of that journal, one from Mr. George H. Gibson, which should be illuminating and highly instructive to readers of the SCIENTIFIC AMERICAN.

Mr. Gibson says, very truthfully to our mind, that "while most American manufacturers are aware that the profits of engineering lie in pioneer work, not all of them as yet understand the proper utilization and management of research. The demand for research is not brisk over here and the schools have done little either to excite it or to turn out men properly qualified to fill the demand if such should arise. Possibly as an incident of rapid commercial expansion, engineering enterprises are generally controlled by business men, rather than by directing engineers, while the technician is a subordinate employee, who receives little encouragement or aid toward the initiation, planning or carrying out of sustained investigations."

In Europe, Mr. Gibson assures us, the situation is different. "The engineer or scientist frequently occupies a more independent position. I am told, for example, that Prof. Rateau, who has developed many lines of centrifugal machinery, including steam turbines, centrifugal pumps, air compressors, blowers, etc., licenses various concerns in France, Germany and elsewhere, that is, his rights are not assigned *in toto* to some corporation, as would probably happen in America.

"Similarly the professors in the leading German technical schools, in addition to teaching, maintain large engineering offices, in which research and experimental development work is prosecuted on an extensive scale. The remuneration received from their inventions and for their engineering work enables these scientific engineers to maintain large staffs, while their connection with the laboratories and the other facilities of educational institutions naturally leads to the full utilization of the resources of scientific knowledge and methods."

Pure Food and What It Means

IF so much of our lives and so much of man's ambition are bound up in the great problem "What to Eat and How to Get It," we surely do well to consider what manner of food we are getting in return for life's struggle, whether, in a word, it is pure, clean and wholesome; whether it is calculated to give us the sustenance and strength, the health and prolongation of life that we have a right to expect, or whether it is sometimes so far a mixture of bad with the good, that almost literally we are given a stone when we ask for bread.

This whole question was ably considered by Mr. L. S. Dow, before a meeting of the Section of Physics and Chemistry of the Franklin Institute. His paper on the subject is here abstracted from the journal of the Institute.

"The rapid growth of the preserving business in its early stages attracted much capital without corresponding experience, and in such cases, for the most part, business disaster was only averted by the extensive employment, in nearly everything produced, of chemical anti-ferments, which served as a protection against all the mistakes of cooking, sealing, and sterilization, and obviated entirely the necessity of proper sanitation either in methods or surroundings. The first objection to their use, however, and, I believe the most glaring abuse that exists to-day, lies in the employment for the purpose of preserving partly spoiled and ill-cared-for vegetables and fruits. The principal substance that is used for the artificial preservation of vegetable and fruit products, as well as for meats and fish in some cases, is the drug benzoate of soda—which, in its least objectionable form, is a tasteless and odorless derivative of coal-tar.

"It is not my purpose to discuss here the extent to which the substance, sodium benzoate, itself may be harmful. That is a scientific question, the discussion of which I am willing to leave to scientific men, confining myself rather to a few brief words concerning its possible significance in food products. But, before proceeding to this phase of the artificial preservative question, I would like to call attention to the fact that the weight of scientific evidence, especially on the part of the medical profession, is strongly opposed to it, and to suggest that if there is a doubt about the amount of injury that it causes, the people, and not the manufacturing interests who desire to continue its use as a means of securing a greater pecuniary profit, should have the benefit of that doubt."

Mr. Dow states that every product of fruit and vegetables with which he is familiar can be successfully made in a commercial way without artificial preservatives, which statement he considers demonstrated because the entire product of at least twenty-five, and probably more, leading American food preservers is entirely free from these substances. "Why, then," asks Mr. Dow, "should any one wish to continue their use? Commercial cupidity yields very grudgingly to attempted reform. There is cannery waste to be worked up profitably into ketchups and soups—skins, cores, and decayed parts of tomatoes, cooked up and thrown into barrels to be shipped about the country for use as wanted. There are always job lots of spoiled or partly-spoiled fruits and other similar materials lying about in the season that can be picked up cheaply. To say nothing of the expense attending its proper disposal, it is hard to send such material to the sewer when profit can be gained from it by sufficiently dosing it with a chemical preservative to protect it from putrid fermentation, and then disguising its taint with spices and flavors until it really becomes quite presentable and, in a degree, acceptable to those who do not discriminate very closely in favor of quality, and who are only slowly learning the significance of the legend on the outside of a package: 'Preserved with one-tenth of one per cent of benzoate of soda.'

"While the demand of the reactionary manufacturer for the continued tolerance of some kind of an artificial preservative is based upon several reasons, the principal pressure in its favor comes from users of tomato waste, which has a commercial importance not generally understood. Tomatoes are probably more extensively canned than all other summer vegetables put together—and all the canning is done in a period of six to eight weeks, under high pressure. Tomatoes are also more extensively used in soups, condiments, sauces, etc., than any other fruit or vegetable—the consumption of tomato ketchup alone running into many millions of dozens annually."

Mr. Dow draws a picture of skins, cores and decayed tomatoes, which there is neither time nor inclination to care for, falling under foot and disregarded as it accumulates. Hundreds of thousands of barrels of this refuse, he assures us, are sold in a season.

"It is pulped and put into the barrels under conditions that would better be left to the imagination than described, and then chemically 'preserved' against actual putridity. It is safe to say that no one would ever again desire to eat any benzoated article after once seeing this material and its treatment.

"This tomato refuse is sold at about $1.00 to $3.00 per barrel, to be made into tomato-ketchup, soup, baked-bean sauce, etc., which are eventually labelled as made of fresh, ripe tomatoes, and which carry only one protection to the consumer—namely, a statement of the presence of the preservative on every label, which is put there under one of the occasional beneficent food regulations of the Agricultural Department at Washington, but it is always printed as small and obscurely as possible. Thus the consumers' only protection is to read all food labels carefully, including the fine print."

Mr. Dow states that it is really around the tomato waste industry that has rallied most of the effort for nullification of the Pure Food Provisions of the National Food and Drugs Act.

A term much employed by the pro-preservative interests in their defence is "concealed inferiority," the contention being that the addition of a chemical preservative to rotten tomatoes or fruit, for instance, changes neither the odor nor flavor of the material. Unfortunately for this line of argument, nobody contends, or ever has contended, that benzoate of soda "conceals inferiority." The expression "concealed inferiority" is simply one coined as a premise upon which to build false argument. Artificial preservatives do not conceal inferiority, but they do permit and encourage disguised inferiority and the grossest fraud.

In order to cheapen the product, Mr. Dow states that many manufacturers retain as much water as they may find convenient. Bottles and other containers need not be washed, and sterilization becomes a useless expense.

"I have no hesitation in saying that the principal use of benzoate of soda and like substances in modern food manufacture to-day is either to permit the use of a lower grade of material, or carelessness in process. Its tendency is to lower quality in some direction all the time, and to invite actually unwholesome practices, and the question of whether we are to have cheapness in our foods at the expense of quality and wholesomeness is as much alive to-day as it was before a food law was placed on the statute books."

The Original Paper Makers

The Paper Wasp and Its Life from Egg Until Death

By Paul Griswold Howes

THE communities of the paper wasp, like those of other social insects of the family, consist of three kinds of individuals—males, females and workers. The colonies only exist for a single season, the males and workers dying in the fall. The females or queens hibernate and each starts a new community in the spring. The queen is the largest in the colony and her one duty, after the first few weeks of spring, is egg laying. The males or drones are created for the one purpose of fertilizing the eggs of the queen and after performing this duty they are frequently killed and thrown from the nest by the workers. These so-called workers are in reality undeveloped females who are unable to reproduce in a beneficial way, as their eggs invariably produce drones. Thus they are unable to assist in increasing the numbers of working individuals in the colony and the heavier work must therefore fall upon these otherwise useless members.

Let us start with the queen mother, the only survivor of last year's colony who has safely passed through the winter in an impregnated and torpid condition and who must now lay the foundations of another great insect city.

When in the spring she lays the first foundations of her future empire, she has not a single worker at her disposal, and with her own hands and teeth she must hollow out a tiny cave wherein to lay the corner stone of her future metropolis. She must herself build the first combs and produce from her own body their first inhabitants, which in their infant state she must feed and educate before they can assist her in the great design. At length she receives the reward for her perseverance and labor, and from being a solitary unconnected individual, in the summer is enabled to rival the queen who gave her birth, in the number of her children and subjects and in the empire of which they are inhabitants. Even at this time, when she has so numerous an army of co-adjutresses, the industry of this creature does not cease, but she continues to set an example of diligence to the rest of the colony. If in any way the queen mother perishes before the other females are hatched, the workers lose their instincts, cease their labors and die.

The number of females in a wasp colony is very considerable. They are hatched about the latter part of July or during the first part of August, at the same time and in about the same numbers as the males. In September and October they fly from the nest and after mating the males live but a short time. Of all the females, few survive the winter to start the new empires when the vernal sun brings the insect world to life again.

To the workers falls the entire care of the young and other members of the colony. They must not only supply the food, which consists of honey and chewed up insects, but they must also protect the nest from outside intruders. These poor "Neuters" must also be ready and willing at any time to do construction work upon the rapidly growing nest. Almost daily there are new cells to be built, walls to be strengthened, openings to be closed and all manner of things which only a worker can do. Of all these operations, no other is so interesting as the process by which the wasp's paper is made. It is, of course, manufactured from wood pulp which is scraped by the worker from old boards, fence rails and other unpainted lumber which has been well weathered for two or three years. These tiny particles of wood fiber are mixed by the wasp with a glutinous substance of some sort which is apparently spit up by the worker herself. Now she rolls the whole mass between her fore feet until a small gray pellet has been formed, and with this she flies to the nest. The pellet is then dropped in the proper place and left until the edge of it adheres to the edge of the cell next to which the new one is to be constructed. When this has been accomplished, the insect draws the pulp from a ball or pellet into a long thin line to the opposite side of the nest. From here she goes back to the start, and places her tong-like jaws over the paper thread, closes them, and simply walks backward away from the point of contact, and thus flattening it into a long gray ribbon which is easily shaped into a low hexagonal cell.

In this manner several layers of paper ribbon are applied, each layer above the other, until the cell is of the proper depth. It is then ready for the delicate white egg which the queen lays almost at its very bottom. The egg is fastened to the paper wall by the same glutinous substance which holds the nest together, and it is almost impossible to remove it without leaving a portion of its tender shell adhering to the wall within the cell.

In the course of a few days the eggs hatch out into soft footless maggots, and it is at this period of their lives that they are subject to the attacks of a very curious beetle parasite called the Xenos. The young of this insect is a tiny active creature which burrows into the body of the young wasp. There it lives feeding upon the body of its host during its hypermetamorphosis. If it is to be a male, it transforms into a chrysalis and soon after this hatches out from the body of the young wasp to live its short adult life, which lasts fifteen minutes to three days. If a female it never turns into a chrysalis, but when the maggot host itself changes into one, the apparently immature Xenos pushes one end of its body out between two of the host's abdominal segments, and there, unlike the female of any other insect family, gives birth alive to a great many tiny beetles in the earliest and most undeveloped stage of their lives.

Owing to the position of the comb, when the young wasp hatches it is suspended head downward in the cell. By means of a glutinous substance (probably the same as the older wasps possess) the larva, as the young one is called, manages to hold itself in place until its head grows large enough to fill the entire open end. When the larva becomes full grown it spins a cocoon of whitish silk, the bottom of which serves as a cap stone to the cell. In this position the young wasp transforms into a pupa or chrysalis and it is then helpless until the time when it issues as a perfect insect. After this event the cell is cleaned out by the workers and used over again by the queen. The whole period required for the transformation, from the time when the egg is laid until the full grown wasp issues from its cocoon, is about four weeks; thus it will be seen that the same cells may be used many times during a single season.

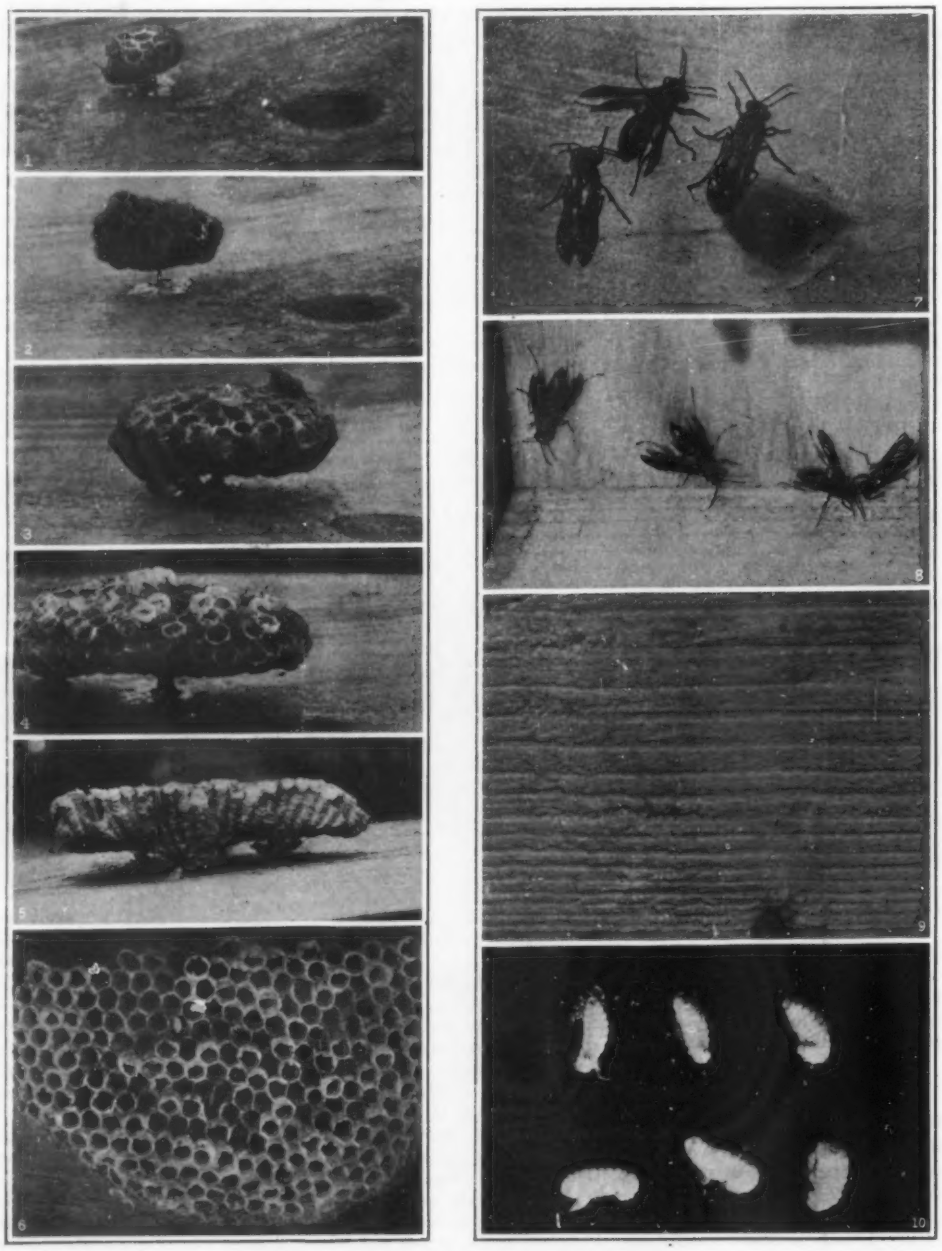
The last brood of the year consists mostly of queens and drones and after these have been hatched, the workers of the colony soon die. The inside of the cells may then be found to contain curious brownish skins, cast off by the chrysalis and which the workers did not have time to remove before the cold weather arrived.

Unlike the large globular nests of the hornets, those of the paper wasps are simply a mass of uncovered cells, ranging in numbers from fifty to five hundred. These are suspended by a single central stem from the under sides of large overhanging stones or from beams in old barns and sheds.

These insects are undoubtedly beneficial from the fact that they have been known to prey upon the destructive cabbage caterpillar in the vicinity of Washington and also in Connecticut. Howard in his Insect Book describes their actions as follows: "The wasps would hover above a plant and then alight and walk about it, but finding nothing, would continue to the next plant and so on to the next. In the sunny center part of the field the cabbage caterpillars were exterminated, but in the shady portions next to a patch of woods, they were present in great numbers. Wasps do not see small objects clearly. They find their prey more by sense of touch than by sense of sight, and as they prefer the sunshine they unconsciously ignored the abundant caterpillars in the shade."

Kirby has left us the following extraordinary account of the manner in which the workers care for the young and helpless members of the community. These observations apply to the common yellow jacket or hornet, but many of the statements hold true in the case of the paper wasps, although I have not as yet been able to verify them all. "The workers are the most numerous, and to us the only troublesome part of the colony, upon whom devolves

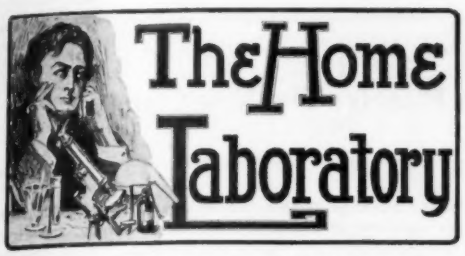
(Continued on page 109.)



Photographs by the author, taken from life.

1. The queen-mother on her first spring nest. 2. Nest of the paper wasp after the first spring brood have been at work. 3. The same nest two weeks later; a worker is feeding the young. 4. The nest two months old, showing broken cell caps through which the young wasps have hatched. 5. Worker wasps strengthening the central stem which supports the nest. 6. Six months old, deserted, and its inhabitants dead. 7. Hibernating queens. 8. A warm day in winter brings the torpid wasps to life; the two in the upper left-hand corner are communicating with their crossed feelers. 9. Section of fence rail, showing (at the bottom to the right of center) gouges made by paper wasp in collecting wood fiber for pulp. 10. Young paper wasps in the maggot stage.

THE ORIGINAL PAPER MAKERS



[The Editor of the Home Laboratory will be glad to receive any suggestions for this department and will pay for them, promptly, if available.]

Simple Electric Furnace

By C. C. Kiplinger

THE furnace herewith described was made out of three fire-clay bricks, two three-fourths inch arc-light carbons, a piece of large rubber tubing, a short length of hoop iron, and a bolt. In less than two hours from the time the materials were collected, the apparatus was in good running order.

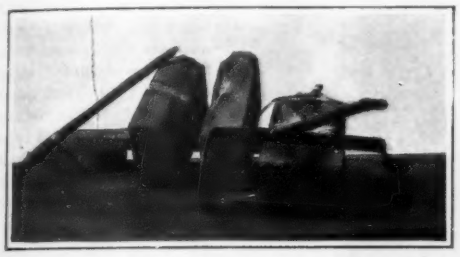


Fig. 1.—The furnace dismantled.

Fig. 1 shows the various parts before assembling. Two of the bricks have one edge beveled as shown, by means of light blows of a hammer and cold chisel, so that when placed face to face, with the latter edges adjacent, a V-shaped trough is formed. This trough should be of such size that, when the carbons are laid in it, the third brick, which forms the cover, will rest flatly on the sides of the other two. The carbons should fit closely, but not tightly, the cover brick holding them in place. A shallow groove is cut in one of the basal bricks, at right angles to the trough, leading to the exterior of the furnace. This affords a means of examining the interior during the combustion.

A piece of hoop iron, or band iron, is bent so as to form a rectangle which fits the base of the furnace closely. Holes are punched in the ends of the iron and a bolt passing through these affords a means of tightening this binding device. If more convenient, the two bricks may be bound together with heavy iron wire.

The furnace as assembled is shown in Fig. 2. The carbons should be copper plated and have the connections soldered to them, although unplated ones may be used. A short piece of heavy rubber tubing is slipped over the end of each carbon to form an insulating handle, by means of which it may be adjusted with safety. If so desired, a small piece of mica bent at right angles may be used to cover the side opening of the furnace. A delivery tube may be inserted in this aperture, and the volatile products of

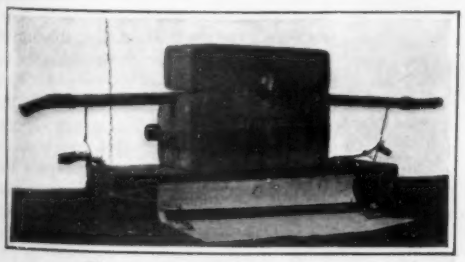


Fig. 2.—The assembled furnace.

the combustion withdrawn by aspiration, for the purpose of their study. Fig. 3 shows the furnace in operation, a spectroscope being used in connection with it, as a means of investigating the chemical changes taking place.

It may be found necessary to use a resistance in connection with the instrument. An unplated arc-light carbon makes a very good and cheap one. Such a resistance is shown in Fig. 2, resting on the sheet of paper at the foot of the furnace. Double brass clips, such as are used in photography to hang prints and films to dry, make very good substitutes for binding posts in this, as well as in other electrical work. The current which is used in the original of this sketch is 104 volts, 15 amperes, alternating.

The chief merits of the above design are its adaptability, cheapness, ease of construction, and the facility with which it may be cleaned and repaired. Fire bricks can be obtained at almost any furnace room. The capacity of this furnace is small, but the reactions are characteristic. Moreover, it may be used either as an arc or as a resistance furnace. For special operations, it may easily be made air tight with a little thick fire-clay, or ordinary clay mortar. The latter

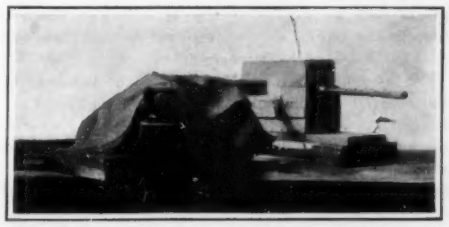


Fig. 3.—Furnace with spectroscope attached.

may also be used to repair defects which may develop with continued use.

Calcium carbide, a typical high temperature product, may be made by finely pulverizing three parts by weight of unslaked lime, together with two parts of coal, and subjecting this mixture for an hour to the action of the arc. Many other interesting processes may be imitated on a small scale, and research work carried on with a high degree of satisfaction.

An Experiment with Aluminium Powder

By Gustave Michaud, Costa Rica College

THE enormous amount of heat evolved during the combustion of aluminium has been applied, in recent years, to several industrial operations. The following easily performed experiment shows in a striking manner the possibilities of the new thermic agent. The amateur is warned, however, that the mixture is highly explosive and must be handled with care, preferably in the open, out-of-doors.

An egg-shell furnace.

Most people would think that the melting of a large gold or silver coin requires some pounds of coal, a furnace and some time. The idea is not unreasonable, as gold melts at 1,064 deg. C. and silver at 960 deg. C. As a matter of fact, however, a silver quarter can be changed within a few seconds into a liquid sphere with the amount of combustible contained in one half of an egg shell, and in a furnace which is the egg shell itself, no blast whatever being used. The feat requires the use of the following mixture:

Aluminium powder	17
Flowers of sulphur	15
Saw dust	16
Potassium nitrate	52
	100

The saw dust and the powdered potassium nitrate are dried separately on the kitchen stove. When cold they are mixed with the other two ingredients. The mixture is then compressed into one half of a dry egg shell. The silver quarter is laid over it, as shown in the accompanying figure, and a match is applied to the composition. The molten silver coin always collects itself into one single lump, which remains highly luminous some time after the combustion is over.

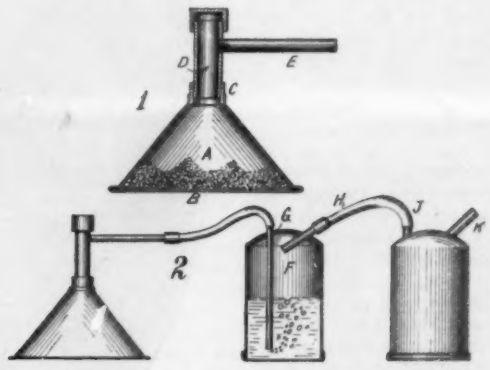
Making Oxygen in Moderate Quantities

By A. J. Jarman

THE experimental production of oxygen upon a small scale with a test tube or glass retort is very useful in demonstrating a chemical point, where only a small quantity of oxygen is needed. When a larger quantity of this gas is required to fill a dozen large vessels or more, for lecture purposes, or for use with the oxyhydrogen blowpipe, for the fusing of metals and other refractory bodies, then resort must be had to a more substantial type of generator. The type of retort and the wash bottles here described have been used by the writer for several years successfully, particularly for the production of oxygen for limelight, for stereopticon and dissolving view apparatus, and for lecture room demonstration.

There are many handy men who will be able to make both the retort and the wash bottles, these latter being made of zinc. Fig. 1 shows the body of the retort, which is made of moderately stout sheet iron, with a flange bent outward at the bottom. *B* represents the bottom, made of sheet copper. The flange of the iron cone being filed clean, the copper is beaten over this flange, then brazed all around in a blacksmith's fire with spelter, using borax for the flux. The screw socket at *C* consists simply of an ordinary iron pipe socket, such as is used for connecting wrought-iron gas pipe. This is also spelter brazed into the top of the cone. *D* is a piece of iron gas pipe of one-inch bore, with a screw cap at the top, and *E* is a piece of three-eighths inch bore iron pipe, with a screw at one end, so as to fit into a hole that has been tapped to receive it at the top of *D*. This outlet pipe also answers the purpose of a handle for removing *D*, so as to place the charge in the retort, as well as acting as a lever to screw the joint quite tight to prevent the escape of oxygen. Fig. 2 shows the arrangement of retort and wash bottles when in action generating oxygen. The advantage of this kind of retort is that it will resist almost any amount of wear and rough usage. At *F* in Fig. 2 is one of the wash bottles in section, showing the oxygen passing down the inlet pipe at *G* and through the outlet pipe at *H*, then down the inlet pipe at *J* of the second wash bottle, thence out at *K*, to the receptacle, which may be either a metal gas holder or an India rubber gas bag. These inlet and outlet pipes are simply made of the ordinary composition metal gas tubing, firmly soldered into the zinc bottles. The connecting tube is a good quality of vulcanized India rubber. Each of the bottles should hold about three pints.

To prepare the oxygen, mix one pound and a half



Making oxygen in moderate quantities.

of potassium chlorate in crystals, and half a pound of peroxide of manganese (the ordinary black oxide manganese). The use of the manganese prevents the chlorate from fusing into a mass, and aids the production of oxygen. The wash bottles must be charged with a pint and a half of cold water. The object of this is to absorb and retain any trace of chlorine that might pass over in case the retort became over-heated, and to cool the gas. The quantity of potassium chlorate here given will produce well over six cubic feet of pure oxygen—in fact, enough to allow of some waste, which is sure to take place in preparing this gas unless exceptional care is taken. As soon as the gas ceases to be evolved, disconnect the tubing, remove the retort from the fire or gas stove, place it upon the ground or stone floor, press one foot upon the side of the cone, give the tube *E* a sharp rap with a hammer, this will start the screwed joint; remove *D* entirely and pour a pint of water (no matter whether it is hot or cold) into the hot retort. This will loosen the contents quickly. The retort should be well washed out and dried, so as to be ready for future use. The water in the wash bottles must be poured off, and the bottles allowed to drain. For those who wish to prepare their own oxygen, the following facts may prove useful: Eight ounces of potassium chlorate will make, under ordinary circumstances, rather more than two cubic feet of oxygen. The chlorate may vary a little in quality, but for all practical purposes these figures will supply the necessary information. Those who wish the information a little more accurate for making oxygen on a small scale will find that one hunded grains of pure potassium chlorate will yield one hundred and eight cubic inches of pure oxygen. There are many other chemicals that will yield oxygen upon heating, but there is nothing that will surpass the potassium chlorate and peroxide of manganese mixture.

The Heavens in August

The Brightest Stars of the Month; The Aberration of Light; The Planets; The New Comet

By Henry Norris Russell, Ph.D.

OVER our heads, as we look up on a clear August evening, shines a very bright bluish-white star. Even a novice in star-gazing will recognize this as Vega, the principal star of the constellation Lyra, and, according to the careful measures made at Harvard, the brighest in the northern heavens.

For the latter honor it has, indeed, two close rivals, Capella being but seven per cent fainter, and Arcturus ten per cent. The very marked differences in color between these stars introduce great difficulties in such a comparison. The eyes of different persons are unequally sensitive to light of different colors and an observer who was unusually sensitive to red light would undoubtedly estimate Arcturus to be brighter than Vega. In making the comparison it is necessary to choose a time when the two stars are equally high above the horizon, for otherwise the absorption of light in our atmosphere, even in clear weather, makes the star lower down seem the fainter.

On photographs, which are far more sensitive than the eye to the blue and violet rays, Vega appears nearly twice as bright as Capella, and fully three times as bright as Arcturus.

Three stars in the southern half of the heavens—Sirius, Canopus and Alpha Centuri — exceed Vega in apparent brightness, but only the first is visible in our latitude. Measures of parallax show that Vega is four times as far away as Sirius so that as a matter of fact it exceeds the latter about three-fold in real brightness.

Telescopically, it is interesting because of its great brilliancy, and on account of a faint companion, some 40 seconds distant, which does not share the motion of the bright star, and presumably lies far behind it. As our initial shows, Lyra is one more example of a constellation wholly unlike the thing for which it is named. Though it boasts no other bright stars, it contains several objects of interest. Close to Vega are two small stars, forming with it a nearly equilateral triangle. The northernmost of these, Epsilon Lyrae, is just separable by a keen eye, and easily divided by an opera glass. A telescope of three inches' aperture will show both components of this wide pair as close doubles, forming a splendid quadruple system. The two close pairs are in slow orbital motion, and all four stars are moving together in space.

The other star of the triangle, Zeta Lyrae, is a wide telescope double, with separation of 43 seconds. A line from Vega through this star carried as far again points out Delta Lyrae—a very wide pair, separated by ten minutes of arc, which is pretty in a field glass. Some five degrees to the southwest are the brighter stars Beta and Gamma Lyrae. The former (which is nearest Vega) is a remarkable variable and spectroscopic binary. It is really a very close double, consisting of two unequally bright stars revolving almost in contact in a period a little less than thirteen days, which mutually eclipse one another. The closeness of a good comparison star makes the variations very easy to follow. At maximum it is nearly equal in brightness to Gamma Lyrae; at minimum less than half as bright. Almost on the line joining these two stars is the Ring Nebula of Lyra—a beautiful object in a telescope of sufficient power.

Not far from Lyra, and just north of the zenith, is the head of Draco, marked by two bright stars, of between the second and third magnitudes. The easterly one of these, Gamma Draconis, is of considerable interest in the history of astronomy, since it was by observing it that the great English astronomer Bradley, early in the eighteenth century, made the important discovery of the aberration of light.

Bradley's original purpose was to observe the position of this star in the heavens, with an instrument of his own invention, much superior in accuracy to those previously used, in the hope of detecting a yearly change in its position, due to the earth's orbital motion about the sun—in other words, what we now call an annual parallax.

If such an effect of the earth's motion should exist, it is clear that the star should appear farther south than usual when the earth was north of the sun (as seen from the star) and farther north than usual when the earth was south of the sun (or the sun north of the earth, which happens in June).

But the actual observations showed a different and very perplexing state of things. The star's apparent position changed, but it was farthest north, not in June, as apparently it ought to have been, but in September—three months late! In June and December, when the effect of parallax should be a maximum, the star's position was almost exactly the same, but between September and March, when no difference owing to parallax could be expected, a large difference was actually observed.

After much puzzling over this strange phenomenon, the true explanation occurred to Bradley while sailing on the Thames, upon noticing that the wind appeared to change in direction every time the boat tacked and changed her course.

Suppose the wind to be blowing from the north, as observed on shore, or on a vessel at anchor. Now suppose the ship to get under way, and proceed due east. In a calm this would apparently produce, for an observer on board, a wind blowing from the direction in which the vessel was heading. The combination of this with the actual north wind would make the wind appear to come from some point east of north. The faster the ship's motion, compared with that of the wind, the greater would be the deviation of its apparent direction.

Now suppose the ship turned about and headed due west. The wind would now seem to come from a point as far west of north as the direction previously observed was east of north. But if the ship was steering north or south, the apparent direction of the wind would be unchanged, though its velocity would seem to be increased or diminished.

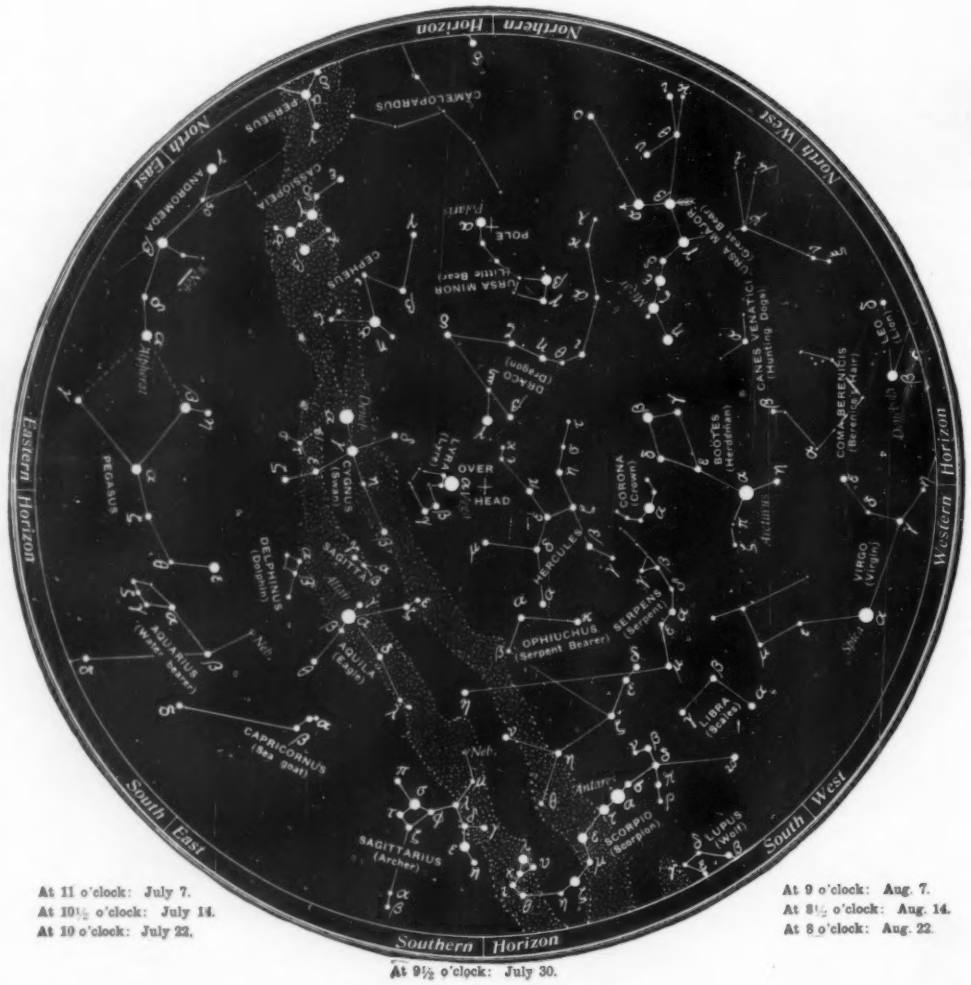
Now the light which reaches us from a star, though in other respects quite unlike wind, possesses like the wind a finite velocity; and the combination of this with the velocity of the observer, who is carried along on the moving earth, produces similar effects. When the earth is moving in any given direction — say northward—the light of a star which is not in the line of motion will seem to come from a point farther north than its true position; that is, the star will apparently be displaced to the northward, and *vice versa* if the earth is moving southward.

Now this is exactly what Bradley had observed—the star being apparently farthest north just at the time when the earth is moving northward fastest—or the sun apparently moving southward at the most rapid rate. This occurs in September and all the other observations are equally well explained.

The mystery was thus cleared up. What is more, a conclusive proof had been given that the earth is not fixed in space, but moves around the sun.

The rest of Draco winds about, first to the right, then to the left and downward, inclosing Ursa Minor and separating it from the Great Bear, which is descending in the northwestern sky. On the other side of the Pole, Cassiopeia is rising and Cepheus is higher up. Following the Milky Way southward, we reach Cygnus, and then Aquila, in the southeast. The great square of Pegasus has just risen and the line of stars which runs from it through Andromeda and Perseus is near the northeastern horizon. The lower southeastern sky is dull, containing only Capricornus and Aquarius, but the region of Sagittarius and Scorpio, in the south, is one of the finest in the heavens, and contains the brighest part of the whole Milky Way.

Spica Virginis is low in the southwest and much less conspicuous than the planet Jupiter, which is a little to the left. Libra, Ophiuchus and Serpens fill a large area of the southwestern sky. Hercules is west of the zenith, Corona Borealis below, and Bootes lower still, Arcturus being almost due west of the zenith.



At 11 o'clock: July 7.
At 10½ o'clock: July 14.
At 10 o'clock: July 22.
At 9½ o'clock: July 30.
At 9 o'clock: Aug. 7.
At 8½ o'clock: Aug. 14.
At 8 o'clock: Aug. 22.

NIGHT SKY: JULY AND AUGUST

THE PLANETS.

Mercury is evening star throughout August, and is best visible before the 12th. His apparent distance from the sun (27 degrees) is unusually large, but, being far south of the latter, he remains in sight for only an hour after sunset and will not be easy to see. Conditions will be most favorable in the early part of

(Continued on page 109.)

The Inventor's Department

Simple Patent Law; Patent Office News: Inventions New and Interesting

Alexander Graham Bell's Ice Stove

A FEW weeks ago we published an article by Mr. W. A. Dupuy on Alexander Graham Bell's ice stove. One of our subscribers has suggested that we publish a picture of the arrangement, so that others may profit by Dr. Bell's ingenuity. The accompanying engraving is the result.

As our readers will remember, Dr. Bell converted his swimming pool into a study and living room. Pipe *A* discharges at *A'* cold air from an ice-box *B* into the lower portion of the swimming pool. In the pipe *A* is placed an electrically operated fan *C*, which receives the air from the ice box *B*, which may be an ordinary ice box, and the air in the pipe *D* leading to the box *B* for supplying fresh air has a suitable valve *E*, by which the supply of fresh air may be regulated. The drawing shows the ice box in a small room adjoining the swimming pool.

A Small Portable Ice Machine

THE modern tendency is toward large scale production. The spinning-wheel may be seen in our homes as an heirloom, but it is silent and unproductive. We find it cheaper and better to have our industries concentrated in large factories, which turn out our clothing, our prepared foods, our ice and what not in bulk. Nevertheless, home "manufactures" have not yet quite passed away, and naturally they too have been modernized by calling to aid the various resources which the development of mechanical and other arts place at our disposal. An instance in point is the ice-making machine shown in our accompanying illustration. This depends for its action upon the well-known fact, that a liquid in evaporating absorbs from its surroundings a certain quantity of heat, commonly termed the "latent heat of evaporation," thereby cooling those surroundings. In order to apply this fact to practical advantage, we need a container from which a suitable liquid, such as water, is evaporated, an air pump wherewith to reduce the pressure above the liquid, so as to cause its evaporation at low temperatures, and finally some absorbent to take up the vapor, and assist in maintaining a low pressure in the apparatus. Referring to our illustration, the rotary pump will be seen at the rear on the left, connected by a ruffer suction pipe to the "absorber." This latter is simply a glass vessel containing commercial concentrated sulphuric acid, which should be free from hydrochloric acid. The purpose of the sulphuric acid is to take up the vapor evolved from the water placed in the vessel (a carafe in our drawing) which is being cooled. This vessel is connected to the absorber by an enamelware tube with rubber ends. A block of ice may thus be formed directly in a carafe of table-water, or a suitable wide-mouthed vessel with adaptable cover may be substituted for the carafe, and any material, such as ice-cream mixture for example, can be frozen.

The Ventilation of Sleeping Cars

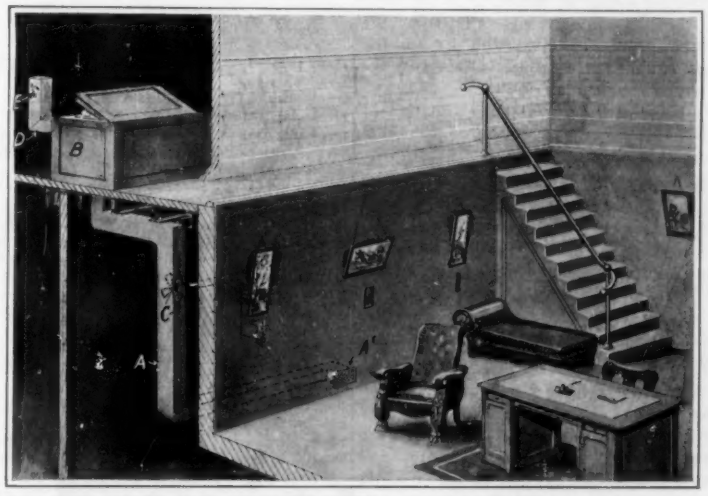
WHEN Dr. Lorentz, the famous orthopaedic surgeon, was in this country some years ago, he expressed his astonishment that so ingenious and inventive a people should tolerate such an unsanitary abomination as the type of sleeping car used on American railways.

What Dr. Lorentz complained of particularly was the lack of ventilation. That subject was ably discussed in a paper by Dr. Thomas R. Crowder, which was read before the annual meeting of the American Public Health Association. Apparently, the ideas of Dr. Lorentz are all wrong.

Dr. Crowder says: "According to the older theories, the sensations of discomfort arising in inclosed spaces had their origin either in an excess of carbon dioxid or an insufficiency of oxygen. Pettenkofer cast the first serious doubt on the correctness of these theories. Hermans proved that air containing 15 per cent oxygen may contain 2 to 4 per cent carbon dioxid and not be harmful. On removing the carbon dioxid there was no great discomfort even when the oxygen was reduced to 10 per cent.

"It seems to be established beyond reasonable doubt that discomfort is not due to any change in the chemical composition of the air, but to physical changes only; and that to maintain a normal heat interchange between the body and the air is to avoid the development of those symptoms which are commonly attributed to poor ventilation. A certain amount of fresh air must be supplied, of course, but the most vital element of the ventilation problem becomes that of regulating the temperature of the air. The question of how to ventilate a railway car is therefore chiefly a question of how to regulate its heat."

In cars which are close or stuffy, Dr. Crowder says, the temperature is invariably high. What is more, a high temperature renders odors more noticeable. The most marked offensiveness that he had ever noticed was in a day coach, where the air was in such a degree of chemical purity as to indicate ideal ventilation by any standard that has ever been proposed.



How Dr. Alexander Graham Bell keeps cool in hot weather.

The car was hot and many filthy people in it. On the other hand, with perfect comfort has been sometimes associated the highest chemical impurity.

"It seems probable, furthermore, that one main cause of the complaint of poor ventilation in the sleeping-car berth is purely psychic. We are used to sleeping-rooms with walls and ceilings far from us. In the berth they are very close. Their very nearness is oppressive. It seems as if there cannot be enough air in this small space to supply our wants. The sensation is often quite independent of the amount of air supplied and even of the temperature.

"Even under the older applied principles of ventilation, the air-supply of sleeping-cars, as determined in this study, is ample under nearly all conditions. The average carbon dioxid in the air of running cars falls well within the limits of contamination permitted by the earlier investigators, and it is relatively rare that the individual observations show more than 10 parts in 10,000. In the light of the newer conceptions, which have as yet been applied in practice only to a very limited extent, this air-supply is ample under all conditions observed. No danger to health is to be apprehended under the conditions ordinarily obtaining even in still cars. They are occupied only for short periods as a rule and are not uncomfortable if kept cool."

In Dr. Crowder's opinion, "the results obtained by the type of exhaust ventilator which is now a part of the standard equipment of the Pullman cars, are entirely adequate to meet the demands of hygiene, and that those difficulties and discomforts which do sometimes arise are due to other causes than lack of a sufficient amount of fresh air or to excessive vitiation. It is extremely unlikely that increasing the air-supply, which now amounts to from six to ten or more times the cubic content of the car each hour, and must maintain considerable motion of the atmosphere, would aid in any other way than by making overheating more difficult to bring about.

"Overheating is the paramount evil. It is the thing to be chiefly guarded against in the attempt to maintain comfort and good hygiene. It is not feasible to cool the naturally overheated air in summer, or to dry it when excessively humid. Fan motors and open windows are the available means by which the difficulties arising in hot weather may be most readily overcome. Carry away the body heat as rapidly as possible by a strong current of air.

"Though the avoidance of overheating in winter would seem to be an easy thing, its accurate control to meet the rapidly changing conditions under which cars may be operated is a matter of great difficulty. Experience has shown that it is necessary to have in sleeping-cars at least twice as much radiating surface as is demanded in common practice for heating the same space in houses; this in order to warm the large volume of air received and discharged so that it will maintain comfort to inactive passengers. To decrease this surface would be to fail to maintain a sufficiently high temperature on occasion.

"A system is needed capable of being quickly and effectively controlled to meet rapidly changing conditions. Such a system is now being experimented with in which there are multiple units of radiating surface, each with a separate control. The results so far indicate that from this a more uniformly comfortable condition can be maintained."

A small vacuum ice machine.

Notes for Inventors

Running a Typewriter With a Perforated Roll.—The problem of manifolding typewritten letters has given inventors no little concern. It frequently happens that thousands of letters, all of them alike, are sent through the mails, letters which are in reality circulars in epistolary form, each of which must appear as if it were intended only for the particular recipient into whose hand it falls. The market is now almost overcrowded with duplicating machines of various kinds, which imitate, with more or less success, typewritten work. One of the most ingenious solutions is the application to the typewriter of the perforated paper roll, which has made the automatic piano player possible. As might be expected, the inventor who has done this, Mr. John McTammany, has been identified with the automatic piano player ever since its inception. In fact, he has good reason to regard himself as a pioneer inventor of the automatic piano player. Mr. McTammany has invented a machine which is to be used

in connection with the ordinary typewriter, and which may be best described as the mechanical equivalent of a pair of hands, capable of turning out ten thousand letters a day. Each letter is an original. As in the automatic piano player, a perforated paper sheet is used. This sheet, whose perforations correspond with certain letters on the typewriter keys, however, does not cause a series of pneumatics to operate, in order to depress the keys of the typewriter, but controls a series of star wheels which actuate the keys. The paper strip is positively fed. By abandoning the pneumatic system of the piano player and yet retaining the perforated roll, the inventor has succeeded in producing a machine which is remarkably compact.

Appreciation of Invention.—It is interesting to note the importance ascribed to inventors and invention in practically all discussions of the developments of business. In a recent article in a popular magazine along the line of business aids and occupying only four short columns, we find reference in three of the columns to three separate inventions, two of which were made by *attaches* of the same business establishment, which is described as encouraging and assisting originality in inventions that can be patented. In explaining his advancement, one of the successful men in the big establishment is quoted as saying that he began making inventions or improving some inventions made by others, and that he was then engaged in the development of another invention.

A Mechanical Violin.—An instrument in the general form of a piano, but seeking to secure the effect of a violin, is sought in a patent, No. 996,614, to Andrew M. Carlsen of St. Paul, Minn. He provides in connection with a stringed instrument like a violin two bows near each other upon the same string. These bows are reciprocated in contact with the string slowly at the same speed in one direction and for a part of the stroke simultaneously and are given a more rapid return movement. During the slow movement in contact with the string, the bows are applied to the string partly one at a time and partly both at the same time, so that each bow will continue the note the previous bow is playing before the previous bow leaves the string to make its quick return stroke. A keyboard is provided for pressing mechanical fingers against the strings by power, and this keyboard controls the power so it is applied to the right fingers and at the right time.

An Advertising Device.—In a patent No. 996,929, to Charles W. Saalburg of New York as assignee of Hans Kempinski of Berlin, Germany, is shown an exhibiting device for use in show windows and similar places, including a tank and a bottle above the tank and tilted to discharge liquid into the tank. Liquid is supplied to the bottle by a tube extending upwardly from the tank and through which the water from the tank is forced by a pump. The tube enters the neck of the bottle and the tube is bent between the tank and bottle to conform to the trajectory formed by the liquid pouring from the bottle into the tank so the tube will be within and concealed by the stream of liquid falling from the bottle.

Six Patents to One Inventor.—William D. Forsyth of Youngstown, Ohio, recently obtained on the same day six patents numbered from Nos. 996,629 to 996,634 inclusive. Two of these patents are for metallic railway ties, one for a brake beam, one for a rail joint, and another for a reinforced concrete cross tie, and one for a truck side frame for cars, the latter being assigned to A. M. Neeper of Pittsburg, Pa. It will be noticed that all of the patents relate to the rolling stock or the roadbed of a railway.

A Combined Flying Machine and Parachute.—A flying machine whose planes normally assume a comparatively flat form, but which can be distorted by mechanism controlled by the aviator into the form of a parachute, is presented in a patent, No. 997,122, to Otto A. Fenn of New York.

A Novel Ice-machine.—A patent, No. 993,771, has been issued to Joseph D. Gallagher, of Glen Ridge, N. J., assignor to a New Jersey corporation, for an apparatus for making plate ice including a tank and a vertically arranged freezing plate, combined with a band saw and operating means for the band saw and means for feeding the band saw upwardly in order that it may separate the cake of ice from the freezing plate.

A Guard for Stick Pins.—A stick pin fastening forms the subject of a patent, No. 996,298, to Adinius R. Sunde, of Antonito, Colo., its novel feature being a retaining prong at the back of the head of the pin and spaced away from the head so that, when inserting the pin, the head can be turned slightly to throw the prong away from a neck tie and when the pin is inserted, the head can be partially rotated to force the prong horizontally into the tie.

A New Hydraulic Ram.—An improved hydraulic ram is presented in a patent, No. 996,056, the invention of Edward R. Brodton of Mobile, Alabama. In this patent a water wheel is placed in the casing of the ram and the waste valve of the ram is operated by the water wheel to closed position, the normal tendency of the valve being toward open position.

A Patent to Edison.—Thos. A. Edison has obtained a patent, No. 996,070, for a rotary kiln for cement. The kiln comprises a long tube which is rotated and has a combustion portion at one end. At its other or upper end the tube is of a greater diameter and is divided into a number of passages.

Patents Assigned to Large Companies.—Nothing better illustrates the high estimate in which patents are held by the business public than the attitude toward them of large business corporations, such, for instance, as the General Electric Company, the Westinghouse Co. and the United Shoe Machinery Co. It appears from the list of patents issued June 27th, 1911, that on that day alone four patents were issued to the United Shoe Machinery Co., as assignee, while on the same day more than thirty patents were issued to the General Electric Co., as the assignee of various inventors including among the number such distinguished inventors and scientists as Elihu Thomson and Chas. P. Steinmetz.

A Portable Bathtub.—In traveling in remote sections bathing facilities are not always available. Warren C. Callahan of Louisville Ky., provides for this in a patent, No. 996,453, by a portable bathing apparatus in which a hoop made of a number of flexibly connected sections so it can be easily collapsed by swinging the sections face to face for convenience in carrying, is set edgewise and a water proof cloth is placed over the hoop and depressed within the hoop so the interior of the hoop forms a tub to hold the water while bathing and the edges of the sheet can after the bath, be brought together forming a water bag to carry the water to a disposal point.

New Wireless Patents.—A number of patents, Nos. 996,088 to 996,092 inclusive, have issued to Maurice Bernays Johnson of San Antonio, Texas, for inventions relating to wireless telegraphy and telephony. One of these patents, No. 996,089, is for a combined wire and wireless telephone system, and another, No. 996,089, is for a combined wire and wireless telegraph system, the former including a wire line at the central station and wireless instruments also at the central station and arranged for connection with the wire line; and wireless communication is established between a transmitter at one end of a space and a receiver and transmitter at the other end of the space, the latter receiver operating its transmitter, switches being provided for connecting the wire line with the wireless instruments and for connecting the wireless instruments with the central operator.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Electrical Devices.

ELECTRICALLY CONTROLLED CLOCK AND TIME INTERVAL TRANSMITTER.—H. I. AIKEN, Fort Mills, Corregidor, P. I. This invention is particularly applicable to time interval signaling, such as time interval systems for artillery fire control, or for other analogous uses employing instruments in which absolute chronometrical accuracy, irrespective of the size, or the weight of, or the load imposed upon the controlled mechanism, is essential.

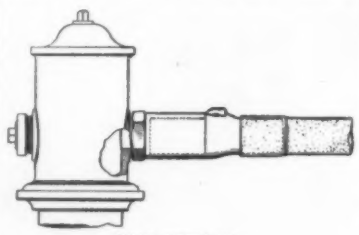
Of General Interest.

COMPOUND FOR TREATING STEEL.—HARRY M. LEE and FRANK G. BOOTH, New London, Conn. It has been found that by using the solution of this invention as a hardening solution, steels can be hardened to the same degree without the necessity of previously heating the steel to an excessive amount, as has been found in the case of certain types of steels when using other hardening solutions. This solution may be also used in drawing the temper of steel, and in such a case, it is heated to the desired degree, and the steel placed therein until the temper has been drawn the desired amount. Since the patent was issued this process has been tried out in large machine shops throughout the country and it has proven highly successful. The patent has been assigned to the Steel Tempering Process Company, 27 Pine Street, New York, N. Y.

ARTIFICIAL RAWHIDE LEG.—W. H. VANORMAN, Auburn, N. Y. The purpose of this invention is to provide an improved ankle joint. It consists in pivoting the leg portion on an axis longitudinal to the foot and on an axis transverse to the foot with the axes intersecting, and with the bearings for the transverse axis resilient, together with means for limiting the movement of the leg portion on the transverse axis.

PROCESS FOR STRENGTHENING CELLULOSE.—X. ESCHALIER, Rue des Fleurs, Villeurbanne, Rhone, France. The invention relates to a process of strengthening cellulose bodies, more particularly the depolymerized cellulose bodies in various stages of hydration, produced from solutions in the different solvents. The strengthening according to this process, is in the nature of a polymerization or a condensation; its effect being very appreciable in the dry State and especially so in the wet.

HOSE COUPLING.—HENRI W. PETERSON, 510 West 58th Street, Seattle, Wash. This invention is an improvement in hose and pipe connections and has for an object to provide a construction in which one of the coupling members will be provided with a packing arranged to be actuated by the pressure of the



HOSE COUPLING.

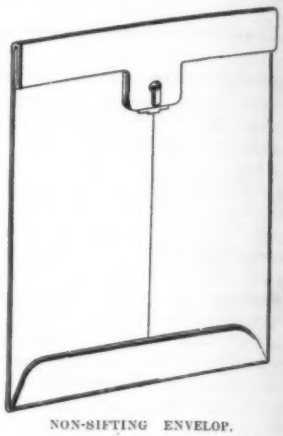
fluid within the coupled pipes in such manner as to render the pipe joint perfectly tight. It may be utilized in coupling air, water or other fluid bearing pipes and is such as to permit the convenient connection and disconnection of the pipes whether it be applied in connection with a hydrant, as shown in the engraving or in coupling two pipes or hose.

CLEANING PAPER AND PROCESS OF PREPARING THE SAME.—J. R. RENTZ, Moline, Ill. This invention is an improvement in a process of treating paper, and the object is to provide a process of this character specified for producing a paper especially adapted for dry cleaning and polishing glass, or the like, without the use of extraneous matter such as soap or cleaning powders.

MOLD FOR CONCRETE STRUCTURES.—J. S. LINTON, Chicago, Ill. The improvement provides a mold or form for making concrete structures, such as walls, columns, beams, etc., and arranged to securely hold the mold parts in position, to allow of raising the mold as the building of the structure progresses, and to temporarily support the concrete material to be used in the formation of the structure.

BAG HOLDER.—P. C. MCCAUSLAND, Walla Walla, Wash. The invention relates to holders for paper bags or similar articles and has reference more particularly to a device of this class which comprises a frame formed into a socket adapted to receive and to hold a plurality of bags, a back, and a movable keeper for releasably holding the bags against the back.

NON SIFTING ENVELOP.—AUGUST P. SPITKO, 216 So. West Temple Street, Salt Lake City, Utah. The object here is to provide means in connection with the envelop for closing the mouth thereof in such manner as to prevent the escape of comminuted or pul-



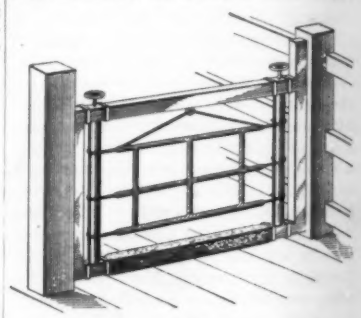
NON-SIFTING ENVELOP.

verulent substances at the end of the flap, where in the ordinary form of envelop there is an opening between the sealing flap and the back of the envelop. It is designed more especially for carrying merchandise. The envelop illustrated herewith has a sealing flap whose inner portion is a double ply, while its outer is a single ply, and the flap folds by folding the single ply onto the double and then folding the single and the double ply onto the envelop.

DETONATOR.—R. A. MOORE, Portsmouth, Ohio. In the patent the invention has reference to an improvement in detonators, and the object is to provide means on the end of a cane which can be operated by bringing the cane down upon the ground forcibly, whereby an explosive tape will be fed and exploded.

FLUE STOP.—J. ARMSTRONG, Alvo, Neb. The invention in this instance has for an object to provide a flue stop for securing a flue cap to a flue hole, to prevent dust, smoke, or soot from passing through the flue hole into a room. For this purpose use is made of pivotally connected bars having lateral flanges thereon and adapted to be removably engaged by a holding screw connected with a flue cap.

GATE.—EDWIN COWELL, 989 Atlantic Avenue, Brooklyn, New York, N. Y. This invention provides a gate for stopping runaways on bridges, roadways, and the like without injuring the runaway in the act of stopping the same. For this purpose, use is made of a frame preferably adapted to swing on a post and having an extensible baffle mounted



GATE.

thereon, adjusting rollers being connected with the baffle to normally adjust the same after the baffle has been extended, and the lower side of the frame being preferably padded to ease the force of impact of the runaway against the gate. The device is shown in the perspective illustration in operative position. Prominent authorities on veterinary matters have indorsed its practicability, among them Dr. William Sheppard, a member of the Royal College of Veterinary Surgeons, London.

Hardware and Tools.

EARTH BORING AUGER CUTTER HEAD.—P. A. BOUCHET, Merced, Cal. The head has a cutting blade shaped and arranged to form a small centering bore in advance of the main bore. The invention also provides in connection with a cutting blade adapted to form the main bore, a second blade whereby the cuttings from the main blade are broken into smaller particles for the freer delivery from the bored hole; and provides means for dividing and guiding the washing water delivered to the bottom of the bored hole between the blades to elevate the cuttings from the bottom of the bored hole.

FLOOR HINGE.—O. KATZENBERGER, Chicago, Ill. Hinges of the type ordinarily having torsional springs that will not stand for any considerable time the strains to which they are subjected are improved by the floor hinge of the present invention, which provides a vertically-movable bolt actuated by the hinge

cam and forced by the cam to return the closure to closed position by a resilient compression spring, in this manner producing a strong and compact hinge structure.

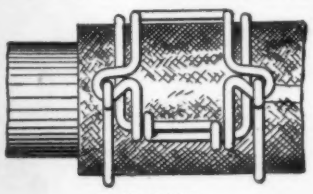
COMBINED HAMES AND COLLAR.—CHARLEY SIEKER, Waco, Neb. Mr. Sieker's invention provides a uniform combined collar and hames whereby to dispense with the usual collar and hames, which may be adjusted for different sized necks, and which when in use will prevent soreness and chafing, equalize and fairly distribute the draft, and which may be

COMBINED HAMES AND COLLAR.

easily placed and removed. The illustration shows the improvement in the position it will occupy when in use, and to remove it, it is only necessary to release the free end of a strap from a buckle. This free end may be now withdrawn from a loop and a ring, when the improvement may be moved from the horse's neck. No injurious strain is brought to bear in any part, the draft being equalized.

SPRAYING NOZZLE.—G. L. GLASER, New York, N. Y. This nozzle is for use in the uniform and economical distribution of water in the form of light or heavy sprays for irrigation, or for spraying water, insecticides, and other liquids for agricultural and horticultural purposes, also for the equal and economical distribution of water and other liquids for fire extinguishment, and for other purposes where the spray may be advantageously used or applied.

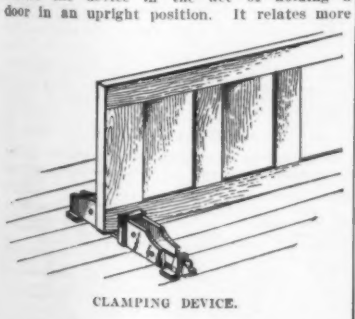
HOSE CLAMP.—HAROLD R. FRANCIS, 474 Salmon Street, Portland, Ore. Among the principal objects which the present invention has in view are: To provide an apparatus constructed and arranged to provide a lever for contracting the holding loop; to provide an expansible and contractible hose holding loop with means connected therewith for exerting the necessary contracting pressure; and



HOSE CLAMP.

to provide means for contracting the clamp and automatically locking the same in contracted position. The engraving shows a side view of a clamp constructed and arranged in accordance with the invention, shown in conjunction with a pipe hose section, and in locked relation thereto.

CLAMPING DEVICE.—DAVID D. THOMPSON, care of Faber Bros., Fort Pierce, Fla. This invention is illustrated herewith and shows the device in the act of holding a door in an upright position. It relates more



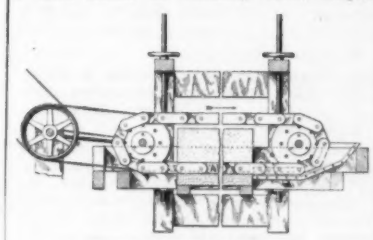
CLAMPING DEVICE.

particularly to devices which are adapted to be used for holding objects, such as doors, blinds, or the like, in a vertical position so that their edges may be planed or fitted with hinges, and comprising jaw members adapted to be moved into engagement with the sides of an object to hold the latter in position. The device in use enables the operator to have both hands free for planing or performing other work on the object so secured.

LOCK.—H. MATHESON, New York, N. Y. This invention has for its object the provision of a device which will be simple in construction, easily adjusted, and with certain parts symmetrically positioned, whereby a portion of the lock can be reversed. It does away with the necessity of having differently beveled lugs for differently swinging doors, by having the face plate beveled and removable, and the openings therein located symmetrically.

Machines and Mechanical Devices.

STONE SAWING MACHINE.—HENRY Q. MAURINO, Albuquerque, New Mex. This invention relates to sawing stone and the machine is shown in sectional side view in the illustration. The object is to provide a device for sawing stone, such as marble and the like. For this purpose use is made of a main frame, an auxiliary frame adapted



STONE SAWING MACHINE.

to move vertically, and mounted on the main frame, an auxiliary frame adapted to move horizontally and mounted on the first auxiliary frame, means for moving the vertical frame, means for moving the horizontal frame, rollers on the horizontal frame, and a chain of saws mounted to turn on the rollers, and adapted to saw stone.

PACKAGING MACHINE.—M. F. ANDERSON, New York, N. Y. In this instance the object of the invention is to provide a new and improved packaging machine, more especially designed for packaging rolls of oilcloth, wall paper and the like, in a very simple manner, in compact form and in a comparatively short time, each package containing a number of rolls.

AUTOMATIC LIFE PRESERVER.—EDWARD W. MILLER, Merrick, N. Y. The invention pictured in the accompanying engraving relates to an automatic life preserver of a type adapted to automatically expand when the wearer falls or enters the water, so as to buoy him up and prevent his sinking. The device can be worn at all times when a person is in a boat, or

AUTOMATIC LIFE PRESERVER.

in danger of falling into the water. It is out of sight and unobtrusive when not in actual use, and will immediately expand when the wearer goes into the water, so as to form a buoyant support which will prevent him from sinking, by means of a gas generated on entering the water, which is collected in a substantially fluid-tight envelope.

CAMERA EXPOSURE INDICATOR.—C. G. IVES, Norwalk, Conn. This invention provides an attachment to the camera whereby an indicator will denote that a film has been exposed when the shutter is operated. Use is made of an indicator for automatically indicating an exposure when the shutter lever is operated and a connection between the indicator and the film winding mechanism of the camera whereby the indicator is returned to normal position when the exposed film is wound on the winding mechanism.

ELEVATOR.—R. E. SNOWDEN, Snowden, N. C. Pivoted buckets carried by belt members, are provided by this invention, the buckets being free to swing through the belt members and there being means to move the buckets relatively to the belt members. Another object is to provide wheels, having spokes with seats for engaging and directing the belt members. Another is to provide the spokes with members for engaging the buckets and holding them in position relatively to the belt members.

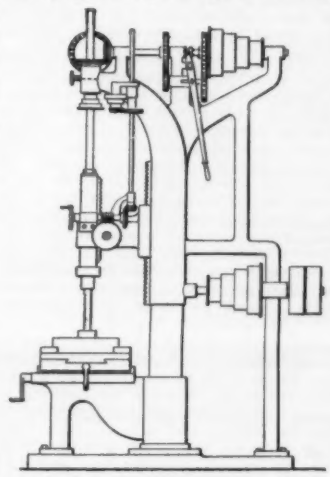
MEANS FOR PRIMING CENTRFIFUGAL PUMPS.—L. DESMARAIS, 10 Rue du Banquier, Paris, France. The priming of a centrifugal pump by using the air suction of one or several cylinders of the motor serving to drive the pump, is effected in this invention. The invention applies to any pump-installation, fixed or movable, operated by a motor whatever be its system, steam, compressed air or other, provided that one of the elements of any kind of this motor normally taking part in its working, can be utilized momentarily as suction pump for the priming of the operated pump which being a centrifugal pump, can only suck when it is primed.

DEVICE FOR CARVING AND GAINING.—R. G. GUPTILL, Itavia, Okla. The object here is to provide means by which the carving or gaining can be done by machinery without necessitating the use of saw, hammer, chisel or bit and brace. A further object of the invention consists in the provision of the device by which stair strips may be gained and which will permit the movement of the stair strip in any direction thereby facilitating the operation.

SUGAR WASHING MACHINE.—A. PLECHER and F. KASPAR, Las Animas, Col. An object of this invention is to provide a device which will automatically wash a charge of sugar, and when sufficient water has been supplied will shut off the supply. A further object is to provide a reciprocating washing device, the movement of which is accomplished by means of the water, which is used in the sprinkling operation.

SAFETY SPRING BARREL.—R. L. MARSHALL, Elizabethtown, Ky. An object here is to provide a spring barrel for a watch, disposed upon a solid arbor which extends through the entire length of the barrel, thereby insuring stability. A further object is to provide a device in which the size of the jewel holes are reduced, thereby lessening friction, without sacrificing stability.

RECIPROCATING AND ROTARY PRESS.—JAMES D. MCCLELLAND, JR., 40 West 6th Street, Mount Vernon, N. Y. This invention relates to a machine drill, which can be used either as a drill press for performing drilling operations on the work or as a reciprocating press, for performing such operations as form-



RECIPROCATING AND ROTARY PRESS.

ing mortise and tenon joints, key-seating, faceplaning, or the like. A further object is to provide a machine tool which can be readily changed so as to operate either as a drill press or a reciprocating press, by connecting one or the other portion thereof in driving relation with the main drive. The accompanying illustration shows the press in a side view.

REGISTERING DEVICE FOR TYPE WRITERS.—H. P. HARMON, Kalispell, Mont. The invention is an improvement in registering devices for typewriters, and the object is the provision of a simple, compact, and accurate registering device for attachment to any approved form of typewriter, which will correctly register the number of words written, and which may be easily attached and detached.

FLYING MACHINE.—A. H. FRIEDEL, Baltimore, Md. One of the objects in this case is an improved construction of flying machine embodying extensible controlling devices in the nature of slides or curtains which may be opened or stretched at the will of the aeronaut for the purpose of steering to the right or left, or for overcoming the momentum of the apparatus.

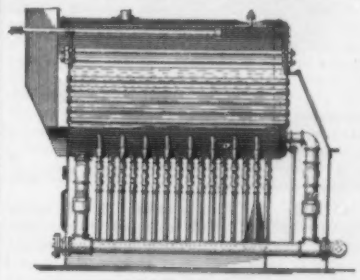
APPARATUS FOR CONDENSING FIBROUS MATERIALS PREPARATORY TO SPINNING.—B. BOHLE, Werdau, Germany. The invention has for its object a roving machine especially designed for treating tow waste and other difficult materials, comprising a film divider and condenser, and characterized by the provision of special means for preventing the films from becoming wound around the edges of the dividing bands or adhering to the same.

Prime Movers and Their Accessories.

INDICATOR FOR SPARK PLUGS.—A. R. LAMBERSON, Albany, N. Y. In this invention the improvement relates to indicators for spark plugs, the more particular purpose being to provide an indicator having generally the form of a testing tube into which the operator may look in order to ascertain the electrical condition of a spark plug to which the indicator is applied.

ROTARY ENGINE.—J. M. FOY, Palatka, Fla. The object of this inventor is to provide an internal combustion, rotary engine which is compact in form, and can be exactly governed, in which the exploded charges are thoroughly scavenged from the cylinders, in which the exhaust gases are to a large extent carried off from the vicinity of the engine, and by means of which any desired number of explosive cylinders can be combined in one prime mover.

STEAM BOILER.—NICHOLAS A. UREN, JR. care of Arlington Hotel, Seattle, Wash. The invention illustrated herewith provides for a boiler a supporting structure formed of water circulating tubes connected with the boiler drum; provides for a boiler of the drum type a fire box, the side and head walls of which are formed in part by water circulating tubes connected with said boiler; provides a sup-



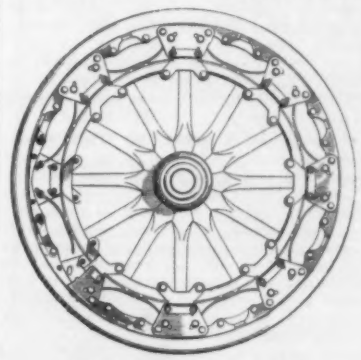
STEAM BOILER.

porting structure for the drum boiler so as to avoid lateral extension of the fire box; provides a water circulating system embodying circulating manifolds; provides a connecting pipe between said manifolds to balance water supply thereto; and provides a supporting structure for the drum boiler constructed from tubes having screw threaded connections by the manipulation of which the horizontal arrangement of the boiler may be varied.

Pertaining to Vehicles.

AUTOMOBILE TORPEDO.—A. E. JONES, Fiume, Austria-Hungary. The object here is a percussion mechanism or pistol for automobile torpedoes. The invention aims more particularly at permitting of the release of the striker no matter at what angle the torpedo strikes its mark, while at the same time avoiding any incorrect operation and the cocking of the striker before and during firing and so long as the torpedo is in proximity to the vessel from which it is launched.

FLEXIBLE METALLIC TIRE.—WILLIAM C. NICHOLSON, Crown Point, Ind. A flexible tire for automobile or other wheels is pictured in the accompanying engraving. The invention is designed to take the place of pneumatic tires now in common use, and to provide one made largely of metal which will



FLEXIBLE METALLIC TIRE.

have resiliency and durability, but not be subject to the annoyance of puncture and other inconveniences arising from use of pneumatic tires. The tire has sections, each being movable against springs so that as the wheel is rotated, the load comes successively upon the separate sections which give slightly, in the manner of the pneumatic tire.

Railways and Their Accessories.

RAIL JOINT.—G. U. DAVIS, P. O. Box 116, Altheimer, Ark. This invention is an improvement in rail joints and has for an object to provide a construction whereby to support the rails at the joints as thoroughly and efficiently as they are supported at other points with a special view to overcome the difficulties resulting from low joints incident to the ordinary rail joint now in common use.

Designs.

DESIGN FOR A PENCIL DISPLAY STAND.—W. H. DALTON, West Hoboken, N. J. In this ornamental design for a pencil stand, the stand comprises a flat base of curved outline on which are placed the four perforated uprights that hold the pencils. A center piece culminating on a point caps the stand and producing an attractive design.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12501) F. M. E. asks: Is it worth while for some of our aviators to watch for an opportunity and rise in the wake of a rain cloud and see the rainbow a complete circle? It would certainly be a beautiful spectacle and will be seen by very few. A. Whether one would think it worth while to rise in the wake of a rain cloud on the chance of seeing a complete rainbow, we cannot say. It would be a unique experience, if it should be successfully accomplished.

(12502) J. W. C. asks: 1. A cubic foot of air in a globe or vessel that weighs, say 2 pounds, would require a certain weight to sink it in water. Now if it is compressed to 64 cubic inches, and the container is same weight, would its buoyancy be the same, or would more or less weight be required to sink it in water to same depth? A. A cubic foot of air at ordinary density weighs about an ounce and a quarter. If it is in a globe which weighs two pounds, the whole will weigh the sum of two pounds. If the globe has a volume of one cubic foot, it will displace a cubic foot of water, which weighs if fresh about 62½ pounds, and it will be buoyed up by a force of about 60 pounds 6¾ ounces, the difference of these two weights. Now, if the air be compressed to 64 cubic inches, it and its container will weigh the same as before, but will be buoyed up by the weight of 64 cubic inches of water, which you can calculate from the weight of a cubic foot as given above. You will find that the globe will just float in fresh water, the buoyant force being only a very few ounces. 2. What would be the pressure per square inch if a cubic foot of air is compressed to 64 cubic inches? A. If a cubic foot of air is compressed to 64 cubic inches, the pressure at the same temperature will be twenty-seven times the normal pressure, which is 405 pounds per square inch. 3. Have you any books or papers that would be helpful to an amateur in building small rowboats and motorboats? If so, please give me price of same, or tell me where I can get such books. A. We can supply the following books on boat building: "Practical Boat Building for Amateurs," by Nelson, $1; "Canoe and Boat Building for Amateurs," by Stephens, $2; "Nine Motor Boats and How to Build Them," $1; "How to Build a Motor Launch from Plans," by Davis, $1.50; "How to Build a Motor Launch," by Mower, $1. Upon receipt of the prices quoted above, we will forward these books postpaid to your address.

(12503) G. K. asks: My friend's boy, a youth of 18 years, came to me and asked me if iron made into powder form could be electrified, either with positive or negative electricity. Further, he wished to know what the result would be, if both powders were blown through a pipe, each one separate at the point of contact. A. Powdered iron can be electrified if it is insulated, and if it were blown from a pipe while charged with either positive or negative electricity, the particles of iron would repel each other and be driven apart in all directions. If there were two iron powders, one electrified positively and the other negatively, of equal quantity, upon mixing the two powders they would discharge each other and there would be no charge of electricity left, since iron is a conductor of electricity, and can retain it only when it is insulated. We hope that this explains what your young friend wished to know. It would be profitable for such a young man to have the SCIENTIFIC AMERICAN for himself. We hope he may become a subscriber to it.

(12504) A. C. M. asks: Will you please be so kind as to give me a formula in your queries column for making a nickel-plating solution for electroplating? A. For a small bath for nicker-plating, dissolve 12 to 14 ounces of the double sulphate of nickel and ammonium, per gallon of water, in a stone jar which is perfectly clean. Add water till the solution is of a density of 1.03 to 1.06, or from 6.5 deg. B. to 7 deg. B. For large baths a very different method is taken to shorten the time. You will find full instructions in Langbein's "Electro-Deposition of Metals," $4, or in Watt's "Electro-plating," $4.50. A very good small book of very practical instructions is Van Horne's "Modern Electroplating," $1. We shall be pleased to supply any of our readers with these books upon receipt of price.

(12505) W. S. K. asks: Can you furnish me the address of a concern where I can buy a metrescope? It is used in enlarging of pictures, etc. I have never seen one, and can only give you an idea of it. It is made of glass. A. We do not know any instrument which is kept for sale to be used in enlarging pictures. This is usually done by dividing the picture into squares, and the paper upon which it is to be copied into the same number of squares. Then, as you will see, any portion of the picture will be drawn to fill the square on the copy which corresponds to the square which it fills in the original picture. A plate of glass ruled in squares laid over the picture would be very convenient but you can rule fine pencil marks over a picture and afterward erase them, or you can make a light frame and draw a thread across it to form the squares. Other ways will suggest themselves to you for making the square, cheaper than buying a frame.

(12506) D. S. asks: 1. Supposing that a retort or any other receptacle was filled with pure air (with of course provision for its expansion) and heat was applied to the outside of the retort sufficient to raise the temperature of the air in the retort to say 1,000 deg. or 1,200 deg., would that air be fit to breathe after it was cooled to the ordinary atmospheric temperature? A. If pure air containing only oxygen, nitrogen and the other gases which are found in minute quantities in pure air should be inclosed in a retort and heated to 1,500 deg. Fahr., and again cooled, no change would take place in the air. It would be the same as before the heating in every respect. It could be breathed with entire safety. 2. About what proportion of the oxygen would remain in that air, or would nearly all of the oxygen be burned out of it, being as it were entirely isolated from the outside fire? A. The oxygen of the air could not burn with any other substance in pure air in the retort. To cause the oxygen to combine with the nitrogen a temperature very much above 1,500 deg. Fahr. is required. None of the oxygen would be burned at that temperature.

(12507) W. H. P. asks: 1. In the practice of wireless telegraphy does the circuit run in the air, or do they use the air as one wire and the ground for the other? A. A wireless telegraph message is not sent by means of an electric current flowing over a circuit as ordinary telegraph messages are sent. It is sent by means of waves which are sent off into space by the energy of the transmitting apparatus. In the present method of signaling the waves remain fixed to the surface of the earth, and spread in this manner outward in all directions from the aerial wire. Over water they flow with little retardation. Over the earth they follow the surface, up and down as may be, and are impeded so that they die out sooner and do not reach as far as over water. They do not act at all as if they were following a wire. 2. Is there a way in which the receiving instrument of wireless telegraphy can be arranged so that it will have to come within a fixed distance (say a mile) of the transmitting instrument before it can receive a message, and can receive a message all the time within the radius of this distance? A. The receiving instrument can render audible any signal which is powerful enough to affect it. It is a matter of the sensitiveness of the detector. The receiver must be tuned to the same wave length as the transmitter and the detector can then pick signals to which it is adapted. It is not so much the distance from which the signals have come as the energy of the signals and the delicacy of the receiving apparatus.

(12508) W. A. W. asks: 1. How is it possible when listening to a phonograph to hear more than one sound at the same time, although only one needle and one diaphragm, which I assume can only vibrate at one rate of speed, are responsible for the sounds? As an illustration, one hears a vocal solo and accompaniment at the same time. A. Your question about the reproduction of music by the talking machine would be unanswerable if it were true that a diaphragm could only vibrate at one rate of speed. The diaphragm of a piano, the sounding board, vibrates for all the sounds of all the notes and their harmonics. The same is true of the diaphragm of a violin, which is the wood of the back and belly. A plane piece of elastic material, such as in the diaphragm of the recorder and reproducer of a talking machine, has the ability to vibrate in an indefinite number of modes at one and the same time, and the tracing by the needle point is a complicated one which represents all which you hear coming from the machine. 2. Why is it that the tea kettle full of boiling water may be taken from the fire, and sustained from below by the bare hand for several seconds, the bottom of the kettle feeling nearly ice cold to the touch? A. The ability to carry a kettle of boiling water upon the bare hand depends upon several facts. The kettle is no hotter than the water it contains. Any layer of soot which may be on the bottom of the kettle is a non-conducter of heat and protects the hand from the heat of the kettle. The moisture of the hand must first be evaporated before the hand will feel the heat of the kettle. The evaporation of the moisture of the hand causes the hand to feel cool, or as you state it, to feel that the kettle is cold. When all this is over it is time to set the kettle down, for then the metal will burn the hand.

NEW BOOKS, ETC.

THE IGNITION HAND-BOOK. By H. R. Van Deventer, E. E. Price, 50 cents.

Defective ignition is a great trouble maker. The first part of this tract is devoted to the various ignition systems and equipment, and the methods of installing and operating them. The features of the high and low tension systems, popularly known as the jump-spark and the make-and-break, are explained by text and illustration, and their respective adaptabilities, excellencies, and drawbacks are catalogued. The latter part of the treatise is given over to a particular type of magneto manufactured by a Southern firm.

THE STEEL WORKERS. By John A. Fitch. New York: Charities Publication Committee, 1910. 8vo.; 380 pp.; illustrated. Price, postpaid, $1.71.

"The Steel Workers" gives us a series of vivid glimpses into the clanging, roaring, seething inferno of the mill—glimpses that, like the impressions on a running cinematograph film, merge into one faithful picture of men eternally in action at hammer and furnace, at charging machine, stripper, and rolls. Sparks and vapors and molten iron create a background spectacular in the extreme, but the men who toil before this scenic display for twelve hours each day are conscious only of a stern, prosaic duty to be done in the face of ever-present danger, with a weary body at the day's end. "Homestead," Margaret Byington's contribution to the Pittsburgh Survey, took up the family side of the employee's existence. "The Steel Workers" shows us the man in relation to his work. Since the great strike of 1892, which resulted in victory for the employer, the subjugation of the employee has been complete, and men have been discharged for calling meetings to discuss the issues which Mr. Fitch handles in the present volume. As one old resident said, "If you want to talk in Homestead, you must talk to yourself." So Mr. Fitch takes up the cause of the man whose life is molded and fixed by the inexorable will of the steel kings, and leaves to others the interpretation of the steel industry from its administrative, commercial and technics sides.

METAL WORK AND ETCHING. By John D. Adams. Chicago: Popular Mechanics Company, 1911. 12mo.; 88 pp.; illustrated. Price, 25 cents.

This is a handbook giving a list of the simple tools and materials, with concise directions as to their use in the fabrication of such novelties in metal as desk sets, candle sconces, hinges, photograph frames, and jewelry. The designs are in excellent taste, and open up a large field of artistic handiwork to those whose choice falls upon occupations and hobbies of this kind.

HEAT. By J. Gordon Ogden, Ph.D. Chicago: Popular Mechanics Company, 1911. 12mo.; 119 pp. Price, 25 cents.

There are doubtless many who will welcome a short, popular exposition of high and low temperatures in their relations to applied mechanics. Some of the phases of the subject which pass under examination are: Heat and its measurement; the production of low temperatures and their effects upon matter; the production of high temperatures and their uses in connection with the rare metals; the laws of expansion and contraction. There are also chapters on energy and fuels, artificial ice, and steam, boilers and engines.

THOUGHTS ON THE BOOK OF REVELATION. By Uriah Smith. Washington: Review & Herald Publishing Association. Price, 25 cents.

The expounder argues that the very name shows this to be a book of revelation and not a manuscript of concealed meanings. He endeavors to follow what is known as the literal system of interpretation, taking words and phrases in their commonest significance and attempting to show that history has responded to the voice of prophecy.

UNDER THE ROOF OF THE JUNGLE. A Book of Animal Life in the Guiana Wilds. By Charles Livingston Bull. Boston: L. C. Page & Co., 1911. 8vo.; 271 pp.; illustrated. Price, $2 net.

It is indeed an "amazing landscape" which is here unfolded before us in description and illustration, and the *dramatis personae* are no less remarkable and sensational than their background. Still, the Guiana jungles are places where the sensational becomes the commonplace. There are stories of jungle cats that play with rolled-up armadillos as a kitten plays with a ball; of troops of black spider monkeys, precipitating themselves from tree to tree in their terror-stricken flight from the jaguar; of curious and deadly encounters in which birds, beasts and reptiles take part; of strange, loathsome little animals, of birds of ill-omen that follow a tapir calf for days, and of "green dragons" and "crested robbers" that lurk in foliage and prey upon the weak. Whether some of the situations into which the writer brings his animal actors are over-drawn or not we can not say, but he has certainly succeeded in making real to his reader some of the glamor, some of the mystery, and some of the horror of the haunts he describes.

INQUIRY COLUMN

Inquiry No. 9256. Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world.

Inquiry No. 9259.—Wanted to buy a machine for removing the coating of a filbert.

Inquiry No. 9260.—Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

The Heavens in August

(Continued from page 104.)

the month, when he is farther north.

Venus is likewise evening star, but being farther from the sun than Mercury, and very much brighter, is a conspicuous object. She reaches her greatest brilliancy on the 10th, after which the rapid narrowing of her crescent, as she comes between us and the sun, more than makes up for the increase in her apparent size as she approaches us.

At the beginning of the month she sets at 8.40 P. M., and on the 15th a little before 8 P. M. After this she approaches the sun very rapidly, and by the 31st she will be hard to see as she sets about 6.45.

At the beginning of the month she appears as a crescent some 35 seconds in diameter, and 12 seconds in width. On the 31st her diameter has increased to 54 seconds, but her crescent is only 4 seconds wide, so that she sends us less light than before.

Mars is in Aries, and rises a little before 11 P. M. on the 15th. He moves slowly eastward, and increases in brightness and apparent size as the earth overtakes him.

Saturn is close by, but is moving more slowly, so that Mars overtakes him early on the morning of the 17th. At this time the two planets are apparently separated by only 21 seconds—about ¾ the moon's diameter. The moon herself is close by—about four degrees to the southward—and the triple conjunction will be a pretty spectacle in the morning sky.

Jupiter is evening star in Virgo, setting about 10 P. M. in the middle of the month. Uranus is in Sagittarius just past opposition, his position on the 15th being R. A. 19 h. 54.1 m.; Dec., 21 deg. 26 min. Neptune is in Gemini, and rises about two hours before the sun.

The moon is in her first quarter at 6 P. M. on the 1st, full at 10 P. M. on the 9th, in her last quarter at 7 A. M. on the 17th, new at 11 P. M. on the 23rd, and in the first quarter once more at 11 A. M. on the 31st. She is nearest us on the 21st, and farthest off on the 5th.

As she passes round the skies, she comes into conjunction with Jupiter on the 1st, Uranus on the 8th, Mars and Saturn on the morning of the 17th, Neptune on the 21st, Venus and Mercury on the 25th, and Jupiter again on the 29th.

KIESS'S COMET.

A comet, visible in an opera-glass and possessing a tail, was discovered by Kiess at the Lick Observatory on July 6th.

At that time it was in the southern part of Auriga, and rose about four hours before sunrise.

The Original Paper Makers

(Continued from page 102.)

the main business of the nest. In the summer and autumnal months, they go forth by myriads into the neighboring country to collect provisions; and on their return to the common den, after reserving a sufficiency for the nutriment of the young brood, they divide the spoil with great impartiality; part being given to the females, part to the males and part to those workers that have been engaged in extending and fortifying the community. This division is voluntarily made without the slightest symptom of compulsion. Several wasps assemble round each of the returning workers and receive their respective portions. It is curious and interesting to observe their motions upon this occasion. As soon as a wasp that has been filling itself with the juice of fruits, arrives at the nest, it perches upon the top, and upon disgorging a drop of its saccharine fluid, is attended sometimes by two at once, who share the treasure. The first drop being thus distributed, a second and sometimes a third is produced, which falls to the lot of the others.

"Wasps do not as a rule store up honey, but it is found in the cells of some European species as well as in those of America.

"Another principal employment of the workers is enlarging and repairing the nest. They work with great celerity, and though a large number are occupied at the same time, there is not the slightest confusion. Each individual has its portion of work assigned to it, extending from an inch to an inch and a half, and is furnished with a ball of ligneous fiber scraped by its powerful jaws from posts, rails and the like. The workers also clean the cells and prepare them to receive another egg, after the first has passed through all the stages of its life and is now a perfect insect working with the rest."

There is good reason for thinking that wasps have sentinels placed at the entrances of their nests, which, if you can seize and destroy, the remainder will not attack you. This has been confirmed by the author and many other entomologists. If a nest of wasps be approached without alarming the inhabitants, and all communication be suddenly cut off between those out of the nest and those within it, no provocation will induce the former to defend it for themselves, but if one escapes from within, it comes with a very different temper and appears commissioned to avenge public wrongs. In fact, very few incoming bees or wasps will attack the intruder. Perhaps it is because the insect who is returning to the nest sees from afar all that is going on about its home, while the one coming from inside the nest is confronted suddenly by an unusual form when it reaches the usual point of exit. It becomes alarmed, not only for itself, but for the safety of its colony. What follows is only too well known to the student of social insects! When the workers make their rush they are prepared to sacrifice their lives in the execution of their orders.

The first cold weather, after the queens have entered their winter quarters, produces an effect upon them similar to that which is produced upon the woodchuck and other animals subject to torpor. At first a partial benumbment takes place, but the insect if touched is still capable of moving its organs. As the cold increases all the animal functions cease. The insect breathes no longer and has no need of a supply of air; its nutritive secretions cease, no more food is required, and it has all the external symptoms of death.

Thus we will leave the few survivors of a once great insect empire, perhaps huddled behind the picture molding in our bedroom, insignificant now to be sure, but planning, nevertheless, in their insect minds every cell, every gallery, and every passage which is to be built when the new colonies are founded in the first warm days of April.

1912 Prospects for Automobile Industry

By Hugh Chalmers

WITH a great many of the standard cars for 1912 already announced, and with a new manufacturing season well under way, I have no hesitancy in predicting that 1912 will be a most prosperous year for the automobile industry.

I do not say this as a mere matter of form, but because I really believe it. Every large manufacturer of motor cars is vitally interested in the prospects for business. I know of many men in the industry who, after careful investigation of conditions, have arrived at the same opinion as myself.

In my opinion success in the automobile industry depends upon the solution of a manufacturing problem. The days of rapid fire manufacturing and selling, of pyrotechnics and hail-fellow-well-met methods are past. We all know that water will reach its level. It cannot flow up hill and it is bound to flow down as soon as some of it is drained away.

The water has been drained out of the automobile industry.

I believe there is a tremendous market both in the United States and abroad for American-made automobiles. I consider this market will last not only this year and next year, but for many years to come. Yet it is possible in any one season to flood this market. Over-production is the greatest danger to the automobile industry; or, at least, to those manufacturers who do not immediately realize that building and selling automobiles is a manufacturing proposition just like the building and selling of any other commodity.

There is a great market, for instance, for adding machines. Yet it would be

ridiculous to think that manufacturers could build two or three hundred thousand adding machines every year and not flood the market.

I think some manufacturers of automobiles have not yet come to a full realization of the fact that they can build too many cars. Those manufacturers, I surmise, are apt to find 1912 a very hard season before they are through with it. There are some who may find themselves in serious difficulties in the next couple of years unless they plan more conservative operations than they have attempted in the past.

Every manufacturer must realize that for every thousand of population there is only a certain percentage of men of enough means to buy motor cars. The automobile manufacturer must consider his market. The percentage of people of means in every community is almost as exactly as the mortality rates. Only trouble can result from trying to go beyond the fact.

In my opinion the future of the automobile industry lies in the thoroughly standardized medium priced cars. The higher priced cars have a much more limited market than the medium priced cars. They cannot be built in as large quantities, and yet, quite as elaborate manufacturing facilities are required for their production. On the other hand, there are on the market at this time a number of medium priced cars which will give to the average buyer all the service he could purchase at any price. For this class the future possibilities seem to me to be practically unlimited.

I believe, too, that the market for the American medium priced car will extend to all of the automobile centers of Europe. There can be no question but that the American manufacturer is better equipped to build a good medium priced car than his European competitor.

But the medium priced car which is to be a continued success must be well built, well finished and well equipped. It must be able to compete with high priced cars, without discredit to its owner. To this end all of the leading manufacturers are working.

In this matter of greater automobile values one again has purely a manufacturing problem. The high-grade, medium priced car of the future, I suppose, is going to be possible only in an economically conducted factory. I believe this means eventually that nearly all standard manufacturers will be making most of their parts in their own shops.

In the methods of manufacture, too, there have been opportunities for extravagance and waste which, unless eliminated, will create disastrous disproportion between price and value.

I warrant that most of the recognized standard manufacturers have been giving the public more value each year for their money, and I believe that most of these standard manufacturers have now reached the point where they are making only a legitimate manufacturing profit, and in some cases are not making nearly as big a percentage as is considered perfectly legitimate in standard lines.

I think that those manufacturers who build cars of high dollar for dollar value and at the same time refrain from overproduction, have nothing to fear from the future. The automobile has taken a firm place in modern civilization. The world cannot do without it now and will not do without it in the future. The motor car is no longer a toy or a luxury; it is a necessity. There will be a demand for automobiles just as there has always been a demand for horse-drawn vehicles, until something better than the automobile is devised to take its place. With this steady demand I see no reason why a conservative production of good cars at a fair price should not always bring success.

Numerous Gall-stones

THE French surgeon, A. Schachner, removed 14,000 gall-stones from one patient in one operation. Being greatly impressed by the large number, he sent out a questionaire to certain prominent surgeons, asking them to state their experiences as to this point. His results are published in the *Gazette des Hóspitaux;* some of the figures are as follows: Mayo-Robson, often found over 500; at one time 1,058; 2,300. Moynihan, more than 3,000; 7,000 in one case. Mayo, 5,000-6,000. Œschner, 6,780. Deaver, 2,252. Dunlop, 2,011. Morgagni, 3,000. Hoffmann, 3,646. Langenbuch, 4,000. Nauhyn, 5,000. Otto, 7,082.

Gall-stones vary in weight from a few grains to about one ounce. When single, they are usually ovoid in shape, but when present in large numbers they are angular in outline. Gall-stones are much more common in the gall-bladder than is generally supposed. There is hardly an autopsy on an elderly person that does not show from one to several. As long as they are in the gall-bladder they are quite harmless. But when they start to go down the bile duct they are likely to cause serious trouble.

The Current Supplement

FEW of us realize how the science of geography has changed in recent years. A geographer nowadays is a man who studies environments, who examines the forms and qualities of the earth's surface, and who recognizes, defines, and classifies the different kinds of natural units into which it can be divided. His work consists in collecting new information, and in making use of the material thus collected. Mr. A. J. Herbertson, of the University of Oxford, sets all this forth in a highly instructive article in the current SUPPLEMENT, No. 1856.—That light actually exerted a pressure was first experimentally demonstrated by Peter Lebedew and by Professors Nichols and Hull. In an article entitled "The Pressure of Light on Gases," Prof. Lebedew presents the results of an experimental application of the theory to comets' tails.—The planimeter is one of the most widely used of the measurement instruments employed by engineers. So few understand the principles on which the planimeter is based or the methods employed to determine if a particular instrument in use is giving correct results, that Mr. W. L. Durand's article on the subject will undoubtedly be welcomed.—Mr. Frederick C. Coleman contributes an article on a wire rope tramway for German East Africa, which does some remarkable work in an inaccessable yet rich region of Africa.—Mr. Donald Murray, one of several inventors who have done their utmost to introduce the page printing telegraph, presents the first instalment of an elaborate treatise on "The Practical Aspects of Printing Telegraphy," in which he thoroughly discusses the type of machinery that must be employed and the commercial possibilities of that machinery.—Mr. S. O. Mast writes on the effect of light on the movement of the lower organisms.—The practical application of meteorology to aeronautics is considered by W. H. Dines.—Among the articles of minor interest may be mentioned those on the famous star No. 61 Cygni, "A Kerosene Oil Tractor for a Narrow-gage Native State Railway in India," "The Foundation Walls of the Giant Steamship Europa," "A New Registering Steam Meter," and "New Physical Apparatus."

American Phosphate

THE phosphate lands which a year or two ago were withdrawn from entry for settlement by the Federal Government, constitute, it is said, the greatest known phosphate deposit in the world. These lands comprise nearly the whole of Uinta County in Wyoming, and portions of Morgan, Rich and Cache counties in Utah, and of Bear Lake, Bannock, Bingham and Fremont counties in Idaho, making in all about 7,500 square miles of territory which is more or less underlain by phosphate rock. Besides these vast natural deposits, it is pointed out that the gases from the smelters at Butte and Anaconda, which are very injurious to vegetation, may be made to yield sulphuric acid for the manufacture of superphosphate fertilizers.

A Model Hydroplane

ON June 18th, 1911, Mr. Francis Lee Herreshoff and Dr. Carleton Dederer succeeded in making a hydroaeroplane model thirty inches long raise off the water with its own power in a distance of four feet and make a sustained flight for about 250 feet at a height of about 15 to 20 feet in Central Park, New York.

Electricity

Turbine-driven Vessel With Electrical Speed Reduction.—Opportunity for comparing the performance of recent improvements in speed-reducing gears with generator-motor systems of connection between steam turbines and propellers will be offered in the construction of two sister-ship colliers now building for the United States Navy, as we read in the *Electrical World*. The new collier "Neptune" is to be equipped with Melville-MacAlpine reducing gears, while the turbines of the new coal-carrier "Jupiter" will drive generators which in turn supply energy for operating the motors on the propeller shafts.

Power Brakes on New York Surface Lines.—The Public Service Commission has been considering the advisability of requiring all the surface railways of Greater New York to equip their cars with power brakes and folding steps. If this is carried out, says the *Electric Railway Journal*, it would mean the equipment of 3,630 cars, distributed among the following companies: Metropolitan Street Railway, 622; Second Avenue Railroad, 250; Brooklyn Rapid Transit, 1,807; Coney Island and Brooklyn Railroad, 459; Long Island Electric Railway, 16; New York City Interborough Company, 40; Richmond and Midland Companies (Staten Island), 20; Union Railway, 416. In 1910, 455 accidents were reported with double-truck cars equipped with hand brakes.

Terrestrial Magnetism.—The first mention of a magnetic pole is made by Girolamo Fracastro in 1530. Fifty-eight years later Livio Sanuto makes mention of *two* magnetic poles. The scientific development of the theory of terrestrial magnetism may be said to have taken its origin in the hands of William Gilbert (1600), who regarded the earth as a great magnet. This is the same Gilbert who first applied the term "electric force" to the attraction and repulsion manifested by rubbed amber (Greek "elektron"). Certain variations of the magnetic declination were shown to have a period of twenty-six days by Broun (1861), and the significance of this observation was pointed out in 1887 by Adolf Schmidt, who drew attention to the parallelism between the period of declinations and that of sunspots.

The "Loading" of Telephone Circuits.—In an editorial comment upon the effects of the recent hot weather upon the telephone traffic, the *Electrical World* remarks: The recent hot wave, unprecedented in the records of the Weather Bureau for certain sections of the country, has had a remarkable effect in nearly doubling the normal volume of telephone traffic in some of the Eastern cities and towns. The regular telephone subscribers acted as though they could best keep cool by keeping the telephone switchboards hot. It is said that the modern telephone system has rendered possible the modern many-storied office building, by replacing the messengers that would otherwise overcrowd the elevators, so that the telephone is the reincarnate ghost of the displaced messenger boy. Now it may be said that the modern telephone system has substituted talking for walking in the hot-wave intervals of the American summertime.

The History of the Oscillatory Discharge.—It is interesting to note the historical sequence of events leading up to the full understanding of the phenomenon of the oscillatory discharge, which is at the present day of such interest in connection with wireless telegraphy and the design of lightning conductors. The first observation having any bearing on the subject might be said to be that of the astronomer, Felix Savary, who in 1874 observed that the discharge from a Leyden jar would magnetize a needle sometimes in the one direction, sometimes in the opposite. This observation was repeated in 1842 by the great American physicist, Joseph Henry, who rightly attributed the effect to the oscillatory character of the discharge. The theory of the discharge from a condenser was worked out in 1853 and the succeeding years by William Thomson (Lord Kelvin), and Feddersen succeeded in 1858 in actually rendering visible to the eye the alternations in the spark discharge. This was accomplished by means of a rapidly rotating mirror.

Science

The Zodiacal Light.—The zodiacal light, the nature of which is still a mystery, sometimes presents very regular pulsations in intensity and form. In a recent note in the *Comptes Rendus*, Birkeland has stated that these pulsations correspond very closely with the periods found for regular magnetic waves in the polar regions, whence it is suggested that the zodiacal light may have an electrical origin. On the basis of several experiments Birkeland suggests that there may be a ring of luminous matter extending in the plane of the sun's magnetic equator.

White Water.—In a recent pilot chart of the British Meteorological Office many observations of the singular phenomenon called "white water" are collected. It is more frequently seen in the tropical parts of the Indian Ocean than anywhere else, and it impresses some observers as weird, ghastly and awe-inspiring. The ocean has a milky look and the ship seems to be passing through a kind of luminous fog, in which sea and sky appear joined and the sense of distance is lost. The phenomenon is believed to be due to some form of phosphorescence, but a satisfactory explanation of it is yet lacking.

Wonderful Wells of South Dakota.—East of the Missouri River in South Dakota, it is estimated, more than one thousand artesian wells now exist, drawing their water from the supply carried by the underlying sandstone formation, and supposed to come from the Black Hills and the Rocky Mountains. These wells, used mainly for irrigation purposes, are from 500 to 1,000 feet deep, and the pressure of water in the eastern part of the State is sufficient to give a surface flow, except on the highest lands. One well yields 3,292 gallons per minute, and furnishes power for a flour mill by day and for an electric light plant by night. The development of this source of water supply is still going forward.

Meteorological Wireless Telegraphy in Japan.—In the *Journal of the Meteorological Society of Japan* for May, 1911, T. Saki writes of the use of wireless telegraphy in the Japanese weather service. The first wireless weather messages were sent for some time in 1906 between the temporarily established naval semaphore on Hachijojima and the Central Meteorological Observatory. The present system went into operation in May, 1910. All vessels passing within range of wireless communication with any coast station are requested to send a cipher report of meteorological observations taken at 6 A. M., 2 P. M., and 10 P. M. to the Central Meteorological Observatory at Tokyo. If the weather is threatening additional observations are desired. In exchange for this information the Observatory sends out wireless warnings to all vessels within range whenever a typhoon or dangerous cyclonic depression is reported, giving the position of the storm, barometric depth, and direction of movement. Reports are being received from a large number of vessels. Some of them come from as far east as the 180th meridian.

The New International Cloud Atlas.—Copies of the new edition of the International Cloud Atlas have been distributed. On the whole, this work is disappointing, as compared with the previous edition, published in 1896. The definitions of clouds have not been materially altered, except that *stratus* is now defined as "a uniform layer of cloud resembling a fog but not resting on the ground," in accordance with the decision of the International Meteorological Committee. Official status is given to the terms *cirrus uncinus* and *cirronebula*. English-speaking meteorologists will be astonished to learn, from this work, that the common English name of the *alto-cumulus* cloud is "great waves"! The earlier edition contained an "index of figures," in which was given the history, description and author of each of the paintings and photographs. This useful feature is unaccountably lacking in the new edition. Most of the colored plates of clouds are copied from the old edition, but are inferior in workmanship, on an average; and some of them are decidedly less characteristic pictures of the cloud-types depicted.